A
DECISION METHODOLOGY AND ORGANIZATIONAL STRUCTURE FOR DETERMINING THE MISSION ESSENTIALITY OF RAIL SERVICE TO U.S. AIR FORCE INSTALLATIONS

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Railroads are vital to defense logistics requirements. However, Congressional legislation has eroded the "public interest" criteria, which includes national defense, as adequate DOD justification for the railroad industry's retention of unprofitable light density lines. Consequently, some carriers are abandoning rail lines serving defense installations. In response, the DOD established the Railroads for National Defense (RND) Program in 1975. Still, none of the military services have a standard definition of rail service mission essentiality, or an organizational structure or analytical model for assessing the impacts of and alternatives to proposed rail abandonments to their bases. The objective of this thesis, therefore, was to help reduce these apparent shortfalls. To accomplish this, evaluations of past military and civilian abandonment cases were conducted, and senior logisticians across the CONUS MAJCOM's and at HQ USAF were surveyed. This produced 17 criteria considered important in determining the mission essentiality of rail service at USAF bases. The results were further refined by formulating "essentiality scores" and developing a dynamic decision model. This decision methodology should assist DOD planners in analyzing the impacts of lost rail service, thereby preventing poor rail essentiality decisions which could negatively affect our national defense capability.

A DECISION METHODOLOGY AND ORGANIZATIONAL STRUCTURE FOR DETERMINING THE MISSION ESSENTIALITY OF RAIL SERVICE TO U.S. AIR FORCE INSTALLATIONS

A Thesis

Presented to the Faculty of the School of Systems and Logistics

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In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

By

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INTRODUCTION

Background

Federal Railroad Administration (FRA) data show that approximately one-third (55,000 miles) of the nation's 170,000-mile rail network carries only two percent of the total rail traffic and is not economically viable. Within these light density rail lines, i.e., those lines moving less than 5 million tons per mile annually, are about 2,400 miles of line serving 75 defense installations which could become candidates for future abandonment (71:2). This roster of installations includes the 17 United States Air Force bases identified in Table 1.

TABLE 1
USAF Abandonment Candidates (71)

INSTALLATION	LOCATION	APPROXIMATE MILEAGE
Altus AFB	Altus, OK	30
Arnold Engineering Development Center	Tullahoma, TN	5
Carswell AFB	Ft. Worth, TX	5
Ellsworth AFB	Rapid City, SD	110
Grand Forks AFB	Emerado, ND	85
Hill AFB	Ogden, UT	5
Kirtland AFB	Albuquerque, NM	5
Loring AFB	Limestone, ME	185
Malmstrom AFB	Great Falls, MT	80
McGuire AFB	Wrightstown, NJ	30
Minot AFB	Minot, ND	15
Moody AFB	Valdosta, GA	70
Otis AFB	Falmouth, MA	40
Pope AFB	Fayetteville, NC	15
Tinker AFB	Oklahoma City, OK	5
Vance AFB	Enid, OK	35
Wurtsmith AFB	Oscoda, MI	190

Due to past rail line abandonments, officials believe that the rate of such abandonments will continue for the foreseeable future (71:14). This increasing rate of abandonments is evidenced by the following U.S. rail mileage statistics:

TABLE 2
Abandoned Trackage (71)

YEAR	TOTAL MILES	ABANDONED
1944	227,000	
		6,000
1955	221,000	
		10,000
1966	211,000	
		20,000
1977	191,000	
		21,000
1983	170,000	

These abandonments are primarily the result of the decline of the railroad industry which has been caused by the following forces and/or various combinations of forces: (1) changes in the character of output from the American economy; (2) shifts in the geographical pattern of the nation; (3) the economic organization of the railroad industry in particular, and of common carrier transportation in general; and (4) the present nature of railroad technology. An in-depth discussion of these factors can be found in Appendix A; however, a brief review will follow here. (Throughout this presentation, expanded

background material can be found in the appendices).

Since the nineteenth century, our economy has shifted away from the production of goods toward the production of services. Also, the goods produced are increasingly light in weight and high in value, and thus suitable to highway transport (39:4). For example, the use of anthracite coal (a high volume rail commodity) for home heating has been replaced by other fuel sources. Another reason for the decline of the industry can be attributed to the heavy importation of foreign steel, since the railroads had become increasingly dependent on the domestic steel industry (39:6).

Regarding shifts in the geographical patterns, manufacturing, especially of durable consumer goods, has spread more widely throughout the country and rural areas have become depopulated or at best have remained relatively stagnant as the country has industrialized. In addition, the population of the nation has become increasingly concentrated in three major strip developments (39:5):

1. Along the east coast from Portland, Maine, to Norfolk, Virginia, centering on New York;

2. Along the south shore of the Great Lakes from Green Bay, Wisconsin, to Utica, New York, centering on Chicago;

3. On the west coast from the Mexican border to the northern suburbs of San Francisco, centering on Los

Angeles.

The structure of rail rates has created an incentive to move raw materials long distances and final products shorter distances. Accordingly, raw materials tend to move into the strip developments for manufacturing and then the manufactured goods move shorter distances to the points of consumption. As a result, the final products increasingly move by truck (39:5).

Since World War II, the economic viability of the railroad industry has also diminished, with the rate of return on net investment never reaching the 5.0 percent considered adequate by the Interstate Commerce Commission (71:14). Railroad bankruptcies, consolidations, and mergers have caused abandonment of heavy density lines as well as light density lines. This action has occurred in some of the "corridors of excess capacity" identified by the Federal Railroad Administration (71:14).

Finally, present railroad technology has produced flimsy, unstable railcars whose safety is aggravated by deteriorated rail joints and the resultant speed limitations. Characterized by labor intensity, this rail technology encouraged strong unions whose members held crucial positions in the event of strikes, and thus required system shutdowns (39:17-20).

As a result of these factors promoting rail industry

decline, new statutes enacted since 1973 have increased the industry use of economic viability as the basis for rail line abandonments. This became a concern of the Department of Defense (DOD) and occurred despite DOD formal protests before Congressional committees responsible for railroad legislation. Consequently, the former "public interest" criteria, which included national defense, have been eroded as a means for protecting defense essential rail lines (71:2).

Legislative History

Due to the numerous public grievances against railroad abuses of economic power during the 1860s and 1870s, state and federal authorities began to curb such activities. The result of these efforts are today's economic and service transportation regulations. Since recent regulatory legislation is the principal reason for the Department of Defense concerns over the capability of the nation's railroads to adequately serve our national defense needs, a brief background discussion of pertinent railroad legislative acts will be conducted. Five specific acts will be reviewed, followed by an overview of the current legal steps taken during the rail abandonment process. These five Congressional acts include the: (1) Act to Regulate Commerce, 1887; (2) Transportation Act of 1920; (3) Northeast Regional Rail Reorganization (3-R) Act of

1973; (4) Rail Revitalization and Regulatory Reform (4-R) Act of 1976; and (5) Staggers Rail Act of 1980. A more thorough discussion of the legislation and rail abandonment proceedings is located in Appendix B.

The Act to Regulate Commerce of 1887

Although not directly related to today's rail abandonment concerns, the 1887 Commerce Act was the first Congressional legislation to regulate transportation (130:93). In addition, this vanguard legislation was a direct federal reaction to earlier railroad abuses.

Two principal issues were a part of the Act. The first stated that all railroad common carrier service in interstate or foreign commerce came under federal regulation, and the second created the Interstate Commerce Commission (ICC) to administer the Act (130:94). This was important in the regulatory history of the Country in that Congress provided broad overall guidance, and the regulatory body (in this case the ICC) was expected to interpret and implement the Congressional mandates. In addition to these two overall issues, the first six sections of the Act are also important because of the precedent which they established for future legislation.

The Transportation Act of 1920

This legislation brought the railroad industry back

under private control and operation after World War I and also was the first attempt to govern the establishment of new rail lines, extension of existing lines, or abandonment of old lines (112:3).

The Northeast Regional Rail Reorganization (3-R) Act of 1973

The 3-R Act was designed to address the serious problem that resulted from the bankruptcy of the Penn-Central and six other railroads in the Northeast and Midwest (130:107). Since Penn-Central was so large and the service provided was so essential, Congress decided that action was necessary to save the rail lines from collapse. Section 101 of the act states that the:

> Public convenience and necessity require adequate and efficient rail service in this region and throughout the Nation to meet the needs of commerce, the National defense, the environment and the service requirements of passengers, United States mail, shippers, States and their political subdivisions, and consumers [113:986].

As a result, the U.S. government took over control of the bankrupt railroads and established three separate agencies to administer and manage the takeover. These government agencies were (1) the U.S. Railway Association (USRA), to plan the system and distribute subsidies to localities for operations not included in the system, (2) the Consolidated

Rail Corporation (Conrail), to operate and manage the railroad, and (3) the Rail Services Planning Office (RSPO) of the ICC, which is responsible for promoting public participation in the effort, critically reviewing the planned system, and establishing subsidy standards and other regulations (110:28).

The Rail Revitalization and Regulatory Reform (4-R) Act of 1976

The 4-R Act continued much of the reform initiated by the 3-R Act. Indeed, the purpose of the Act as stated in Section 101(a) contains much of the same wording of the 3-R Act. For instance, Congress' purpose in enacting the law was to:

> ...provide the means to rehabilitate and maintain the physical facilities, improve the operations and structure, and restore the financial stability of the railway system of the United States, and to promote the revitalization of such railway system...[114:31].

Thus, Congressional intent was principally the same as with the 3-R Act. The 4-R Act, however, was national in scale, whereas the 3-R Act was restricted to the 17-state region of the Northeast and Midwest (3:5).

While the basic branchline policy contained in the 3-R Act continues in the 4-R Act, certain important changes

were made. Of these, the changes that impact (1) abandonments, and (2) state and local subsidies, are significant in the context of this research, and are discussed in detail in Appendix B.

Generally, the changes established under the 4-R Act's new branchline policy will result in a shift in the balance of power among the railroads, the shippers on the branchline that is proposed for abandonment, the other shippers using the railroad, the stockholders of the railroad, nd the general taxpayer. As a result of the increased subsidies, those seen to gain the most from the Act are the shippers using the rail service and the involved communities. Accordingly, those losing the most are the general taxpayers, who will bear the burden of financing the government subsidies (3:10). However, one important concern has been overlooked. That is the principal DOD concern that in their zeal to restore economic vitality to the Nation's railroads, Congress has eroded the previously mentioned "public interest" criteria as the principal consideration in the ICC's abandonment decision. Therefore, additional time and research will be required to determine the overall impact of the 4-R Act upon DOD installations.

The Staggers Rail Act of 1980

The Staggers Act is the most recent Congressional

attempt to "...provide for the restoration, maintenance, and improvement of the physical facilities and financial stability of the...nation's rail system [115:1897]." Marking the beginning of railroad deregulation, the Staggers Act is considered by some to be more of a "revolutionary" change than a more moderate evolutionary change (128:5). Essentially building upon the 4-R Act of 1976, the Staggers Act is an important piece of legislation with many provisions. However, it is beyond the scope of this research to discuss the Act in depth. As with previous acts, therefore, only those issues affecting DOD abandonment concerns are specifically addressed in Appendix B.

The Rail Abandonment Process

The abandonment process is founded upon federal authority in the United States Code (USC) of laws. Incorporating the enacted rail legislation discussed previously, the legal statutes are interpreted and implemented by the Department of Transportation (DOT) and the ICC through their preparation of the related Code of Federal Regulations (CFR) (71:17). Although the abandonment statutes are contained in Title 49USC, Sections 10903-10905, the implementation and details are found in Title 49CFR, Part 1121. The process of civil rail line abandonment is detailed in Appendix B.

Justification

Because of economic conditions and previously mentioned legislation, railroads have begun a series of abandonments of rail lines leading to a number of military installations. In addition, because of light density, many other lines are considered potential abandonment candidates. Since most of these lines are considered defense essential, abandonment could have serious impact upon mission performance of the various bases, thereby affecting our national defense posture.

National defense depends on a complex transportation network to project military power to the far reaches of the earth. The wide-ranging interests of the United States in world affairs make strong demands on that network. In addition, rapid response becomes a key factor in the deployment of forces to crisis areas to protect those interests. In recent years, rapid movement has been associated only with the use of airlift. However, much heavy equipment, such as tanks and self-propelled artillery, cannot be moved by most existing aircraft and must be conveyed around the world by sealift. (Examples of these equipment items can be seen in Table 25 of Appendix F.) The railroads have the only significant capability to meet the demand for heavy lift on inland transportation to tie together the installations with the seaports or aerial

ports (54:2).

Thus in the event of mobilization, U.S. railroads would carry most heavy military cargo to U.S. ports of embarkation (19:16). Advantages that tend to favor railroads over other transport modes such as highways include:

1. Appreciably fewer size and weight limitations on the movement of oversize and overweight cargo such as tanks (19:16);

2. Port conjestion can be more easily controlled by regulating the rate at which trains are released from enroute rail yards (19:16);

3. The capability to move very large quantities of cargo, and to have it staged and easily retained in the planned sequence required for efficient ship (or wide-bodied aircraft) stowage at the port of embarkation (19:16).

During peacetime, however, utilization of railroads for defense needs is extremely limited. For instance, defense rail shipments by government bills of lading total less than one percent of the nation's rail shipments (19:17). (USAF base car load volumes can be seen in Table 26 of Appendix F.) Because of this low peacetime usage, government transportation planners have essentially neglected railroads in recent years (32:27). Instead, the

planners have concentrated on planning, implementing, and financing highway and airport systems. Consequently, during the last several decades, government action has been begrudging (or negative) rather than promotional toward U.S. railroads (32:27). This is primarily because no substantial portion of the population travels by rail, and public attention is more keenly directed toward the passenger-carrying modes. Current thought on transportation planning is explored in depth in Appendix C.

This attitude toward railroads exhibits greater significance when the terms "rails" and "defense" are combined. When DOT analyses of potentially uneconomic light density lines outside the Northeast were conducted, "special situations such as those related to the military and 'high and wide' shipments were not addressed [62:156]." Although the Transportation Research Board now suggests that "research should be undertaken to determine the capacity of railroads to meet future national emergencies, especially those arising from national defense requirements [97:24]," little follow-up has occurred. Instead, official national transportation policy has only addressed this area indirectly by attempting to correct past inequities in regulation. The main goal of this policy is to sell Conrail to the private sector, hopefully as one piece, with the intent to retain essential services to small cities throughout the Northeast and Midwest (23:31-33).

The necessity of forcing a change in government response toward the railroads has become apparent. Continued rail decline should not be allowed to progress because, in many instances, there is no other mode capable of or suitable for replacing railroads as a common carrier of freight (32:28), especially heavy military cargo. Evidence of recent DOD apprehension on the condition of defense lines has been detailed in Appendix D.

Problem Statement

Although the Military Traffic Management Command (MTMC) administers the Railroads for National Defense Program, they are primarily a coordinating and consulting rather than an analytical agency. MTMC has prepared preliminary guidelines, DOD Options and Procedures for Civil Rail Line Abandonments Affecting Military Installations Requiring Rail Service, but has requested that each military service develop its own abandonment alternatives analysis procedures (22; 84). Currently, none of the military services have a standard definition of rail service mission essentiality, an effective rail program or organizational structure, definitive procedures, or an analytical model for assessing the impacts of and alternatives to proposed civil rail line abandonments.

Research Objectives

The purpose of this thesis is to develop a formalized

methodology for defining and determining rail service essentiality and to recommend organizational responsibilities for contending with potential rail line abandonments to USAF installations.

Scope

Because of the peculiar nature and specific requirements of each military service, this thesis will be limited to the establishment of an Air Force decision methodology for determining rail mission essentiality and an organizational structure for reviewing abandonment alternatives. However, these proposals should provide the other military services with the necessary framework for establishing their own procedures.

Research Questions

The following questions have been identified for this study:

1. What are the alternatives to rail line abandonment?

2. What are the potential impacts of rail abandonments on military installations (based on experiences of civilian communities and selected military bases)?

3. What decision criteria should Air Force managers use to define/determine the mission essentiality of base

rail service?

4. How should these criteria be incorporated into the mission essentiality decision?

5. What USAF base, MAJCOM, and HQ USAF organizations should be responsible for the various procedures in the abandonment alternative analysis and mission essentiality decision?

Plan of the Report

This introductory chapter has presented the background (as supported by appropriate appendices) and the research objectives for the thesis. The background and detailed appendices reviewed such areas as railroad industry trends, legislative acts to address these trends, transportation planning concepts, the role that railroads play in national defense, and DOD concerns about the current railroad situation. Chapter II is a literature review relating contemporary thinking on rail abandonment alternatives and impacts. Chapter III is a discussion of the methodology used to gather the necessary rail essentiality data and to develop the decision model. Chapter IV presents an analysis of the data, followed by formal development of the model. Finally, conclusions and recommendations are presented in Chapter V.

CHAPTER II

LITERATURE REVIEW

Abandonment Alternatives

The Military Traffic Management Command's (MTMC) assessment of civil rail line abandonments reveals the following eight Department of Defense (DOD) options:

1. Carrier retention of the line;

2. State retention of the line;

3. Shipper retention of the line;

4. Increased traffic above the break-even volume;

5. Increased carrier freight rates;

6. Off-base outloading at the next available rail-head;

7. Mission relocation to another installation;

8 Financial assistance to the rail carrier (71:Section 7).

Prior to discussing each of the options, it should be noted that specific features were incorporated when ordering the options. First, they tend to be in order of decreasing impact upon the carrier. Second, they tend to be in order of increasing cost and impact upon the

Department of Defense. Third, they are presented in a reasonable semblance of chronological order. In addition, since responsibility for the first five options is primarily limited to MTMC and the role of USAF is minimal, a more cursory treatment of these will be given. The last three options, however, require a thorough abandonment analysis by USAF and could require the use of military construction program (MCP) and/or operations and maintenance (O&M) funds; therefore, more detail will be devoted to these options (71:35,38). Finally, where appropriate, additional amplification of several of the options is included in Appendix E.

Carrier Retention

The first option is for the carrier to simply retain the line. MTMC, after receiving notification of carrier intent to abandon the line, writes to the Chief Executive Officer (CEO) of the rail carrier. By jawboning (exhortation), MTMC informs the CEO that the line is essential to national defense and requests that the company reconsider their abandonment proposal and retain the line. Information copies of the MTMC and carrier correspondence are provided to the applicable military service, major command, installation, the Federal Railroad Administration (FRA), and the State rail planning office.

State Retention

The second option occurs when MTMC requests that applicable state rail planners incorporate the connector line into their respective rail programs. Because the programs are jointly funded by the State and the FRA, MTMC also urges the FRA to give favorable consideration to the defense essential connector line.

FRA financial assistance for the State rail programs is to be used only for those lines which potentially can become economically viable (71:36); therefore, the scope of protection may be only temporary, e.g., 2-3 years. As such, long-range plans must be made to ensure line growth.

Although the issue of funding is central to whether state retention is viable, there is something inherently disturbing to most individuals about subsidizing a railroad in order to receive local rail service. For many years, railroads were viewed as a hallmark of the American free enterprise system. In many cases, however, other modes of transportation have been subsidized to the detriment of railroads. Therefore, subsidizing rail service should not necessarily be viewed as an indication of its failure, but as an attempt to bring into balance governmental assistance to the transport sector (17:54).

Under Section 304(c)(2) of the 3-R Act, operators of subsidized service were entitled to receive "the difference

between the revenue attributable to such rail properties and the avoidable costs of providing service on such rail properties (8:20)." The nature of these management fees have been confused with a reasonable return on value. A reasonable return on value is a rental or lease value that is payable to the owner of property used (the estates of bankrupt railroads). On the other hand, a management fee is paid to the operator of a service that uses facilities which it does not own or in which it has no capital investment (the so-called "designated operators") (8:20).

Early operating agreements or contracts for subsidized services between railroads and their users were neither generous nor fully compensatory. They provided no mechanisms for changing the low quality of service which had contributed originally to the low traffic levels on local branchlines. For these reasons the states proposed the use of management incentives (8:21). The FRA, as financial administrator of the programs, did not encourage the concept because the incentive formulations would confuse any forecast of the funds that would be necessary for a given states' program. In addition, Conrail was unwilling to accept the provision of management incentives because they would also involve the possibilities of penalties (8:22). Instead, Conrail wanted a "fee", primarily because of its views on the legislation which clearly identified Conrail as a for-profit corporation. Finally, the administration and Congress also wanted to

incorporate a management fee because it placed a legal obligation only on Conrail to provide subsidized branchline service . Otherwise, other solvent or profitable railroads would have no legal reason to participate in the program (8:23).

Whenever large amounts of public funds are to be used for a project or program, there is a natural desire on the part of the public funding agencies to have control of the entity receiving the funds. In the present context this means that some states have considered acquiring rail properties . This is not a new phenomenon since a large number of early railroads were owned by states for this very reason (17:61). For example, the Western and Atlantic Railroad was constructed by the State of Georgia between 1841 and 1850. After state operation for 20 years, the railroad was leased to a group of officials of connecting railroads for the next 20 years. The railroad was leased under bonds totalling $8 million to operate and maintain the road, plus $25,000 a month to the State Treasury. In 1890 the railroad was leased to the Nashville, Chattanooga, and St. Louis Railroad for $35,000 per month for 29 years. The lease was renewed in 1919 for 50 years for $45,000 in monthly rent and $600,000 per year for improvements which would become the property of the State. Currently, the railroad is approximately 134 miles long and the State has a lease with the Louisville and Nashville Railroad through December 1994. Since they have not sold or abandoned it,

it would appear that the State of Georgia has benefited from ownership of the Western and Atlantic (17:61-62).

As another example, in late December 1961, the president of the Rutland Railway applied to the ICC for permission to abandon its total operation in the states of Vermont and New York. The 331-mile Rutland had suffered a long labor strike and it did not appear that labor would be willing to work for what the railroad's management felt was necessary to continue operations. The State of Vermont opposed the petition and negotiated to acquire the railroad and to lease or sell the purchased trackage to anyone willing to resume operations. The Vermont legislature appropriated $2.7 million and created a state transportation authority to administer the operation in 1963. The Vermont Railway, incorporated in 1963, operates the 122 miles between White Creek and Burlington through a 40 year lease with the state authority and rent based on a percentage of gross operating revenue. Vermont officials were so pleased with the entire operation that they have purchased two other rail operations in Vermont, the Green Mountain Railroad Corporation, and the St. Johnsbury and Lamoille County Railroad (17:62).

As can be seen, states and localities were very much involved with railroad operations before the existence of federal legislative direction. But long-term planning of railroads by the states and even by the industry has been

fragmented, uneven, and generally non-responsive to public concerns. However, Title IV of the 3-R Act brought the states into the planning field by setting the following conditions for subsidy elibigibility:

1. The state must have established a plan for rail transportation and local rail services that is administered or coordinated by a designated state agency and that provides equitable distribution of subsidies among state, local, and regional transportation authorities (32:29).

2. The state agency must have authority and administrative jurisdiction to develop, promote, supervise, and support safe, adequate, and efficient rail services (32:30). Thus, states wishing to obtain federal funds had no choice but to mount thorough, intensive study efforts with the additional burden of limited time allowed under the act.

The first step taken by most of the states in preparing rail plans was to postulate and adopt goals for the plan that set directions for rail transport in relation to the other transportation modes. Multimodal transportation planning is a fairly recent function of the states and generally has been undertaken by states on their own initiative. State and local governments, however, have traditionally planned for highways and roads within their jurisdictions and except for federal-aid highways, have done so with little federal intervention

(81:54).

While the goals of the plans are difficult to determine, the information needed for state rail planning is not. The procedure typically used is to identify a set of specific variables presumed to be affected by rail abandonment, quantify the potential impact of abandonment of individual rail lines on each variable, develop a weighting value for each variable, and finally develop a composite index value for each rail line (7:2). Because there was no central data base available, the data were often difficult to acquire. As such, only the individual railroads and their customers could provide the specifics. Consequently, the expense of collecting the data rose proportionally with the thoroughness and detail of information desired. In addition, the cost of removing uncertainty was high (32:30).

The difficulties of developing a rail data base are compounded by railroads frequently operating across the boundaries of several states. Additionally, line-by-line data have to be more specific than those that are typically available to outside parties. Along with the current data base, forecasts of future demand for the railroads and railroad supply conditions generally are made either through scaling down national projections or by using specific surveys and judgemental input (32:31).

Despite the difficulties associated with rail planning, it is still relatively inexpensive compared to plan implementation. Providing matching funds for operating subsidies, assisting in renovations, and helping to relocate industry cause problems. Any form of user charge is likely to be instituted only with great difficulty. General state transportation funds are uncommon, and highway funds almost certainly will not be available for any major rail demands. If the rail sector requires extensive subsidy, the money can come only from federal or state general funds. Proper pricing of the competing modes and removal of regulatory handicaps could prevent state budgetary drains. Therefore, states might well support substantial federal reform (32:33). (Further analysis and discussion of this issue are detailed in Appendix E.

Shipper Retention

The next option is an attempt by MTMC to have other shippers along the proposed abandonment retain the line. MTMC accomplishes this by gathering traffic data from the other shippers and informing them of their collective interest in retaining the line. This, hopefully, would unite the shippers in urging carrier retention of the line

or in contacting shortline carriers to provide service. Although having a low probability of success, MTMC feels that it is necessary to explore this option prior to proceeding with the others.

A principal option available for shipper retention is to contract with a shortline railroad to provide service. Shortline railroads are small railroads and depending upon their annual revenues, are classified by the ICC as being Class II carriers (revenue between $10 and $50 million per year), or Class III carriers (revenues under $10 million per year) (37:68). According to the American Shortline Railroad Association, there are about 375 shortline carriers who operate a total of more than 1200 miles of track. Shortlines operating today fall into two broad groupings--those traditional lines that have been operating for many years, and the "new breed" lines that were established during the last 15 years. The major distinguishing feature is the method by which the carrier acquired the railroad line it operates (37:68). Virtually all shortlines established in recent years have acquired an existing rail line from another carrier, generally as part of an abandonment or restructuring process.

In order for the shortline alternative to be considered, several other factors besides abandoned trackage should exist. Not all of these preconditions need to be met, but the more that can be met, the greater is the

probablity of a successful shortline operation (17:74). Presented below, these conditions are not structured in any particular order since the importance of each item will vary according to the line's location:

1. Presence of a group interested in continued rail service;

2. Potential owners prepared to hire a professional rail-knowledgeable manager;

3. Acceptable line conditions to help keep rehabilitation costs low;

4. Existence of service and equipment repair facilities that will lower capital investment;

5. Year-round traffic to promote minimal labor and equipment idle time;

6. One or more communities with a population of at least 10,000;

7. A good industrial base willing to use rail if the service is provided;

8. Access to two or more railroads;

9. Capability of intermodal moves;

10. Capability of point-to-point movement;

11. Undeveloped natural resources to ensure future traffic growth;

12. Located in more rural areas with less expensive labor and lower taxes (17:75-76).

Several factors have served as catalysts to favor creation of new shortlines in lieu of abandonment. First, railroad abandonments are politically unpalatable. Once a railroad line is abandoned it is lost forever. Reassembling a previously sold right-of-way can be prohibitively expensive if not practically impossible. Moreover, continued rail service is regarded by many communities as important to their economic well-being because it affects their ability to attract and keep industry. Second, each of the significant freight rail statutes over the last nine years has included provisions designed to encourage new or existing shortlines to preserve branchlines that Class I carriers would otherwise abandon. Third, the existence of federal, state, and local rail funding programs has been a tremendous impetus to shortline railroad activity (37:69).

An examination of shortline railroad successes and failures over the last 10 years suggests many advantages and disadvantages when compared with most Class I railroads. For example, because it is not uncommon to have employees performing several different tasks, it appears

that a major advantage of a shortline is lower operating transport cost due to lower labor cost (17:76). There is absolutely no justification on a shortline for the normal trunk-line types of labor contracts. Thus, the labor contract is the key to lower overhead that gives feeder lines a role in the national rail system (64:60). Moreover, shortlines are becoming an increasingly attractive way for shippers, communities, and Class I railroads to preserve light density branchline traffic (37:73).

As is apparent, several of the shortlines' advantages are the result of their small size. This is also, however, the main source of their disadvantages. For instance, shortlines (1) are frequently too small to be efficient, (2) may have too little traffic to support themselves, (3) may have too much traffic moving at noncompensatory rates, and (4) may have expensive repair equipment and parts inventories investment not usually on a par with their amount of use (37:73). As a result, shortlines are also a risky, capital and labor intensive venture that are inhibited by their inability to achieve economies of scale in their operations (17:77). (Further elaboration on the issues of shipper retention and shortline railroads is located in Appendix E.)

Increased Traffic

The fourth option, increasing rail traffic on the connector line, is more a joint effort between MTMC and the military service than the previous alternatives. After a request from MTMC, the military service headquarters reviews such potential traffic increasing factors as setting delivery dates that make use of rail transport feasible, consolidating shipments, adding facilities to receive petroleum products by rail, converting the defense installation to coal as an energy source, and increasing the portion of training exercises utilizing rail service (71:37). This option could also include changing service levels, i.e., the cost of faster service by truck or air transportation may not be justified.

If the rail lines were viewed as any other economic activity, it is unlikely that some of the alternatives previously noted would be the alternatives evaluated. The basic problem in most proposed branchline abandonments is an economic one, i.e., the costs of operation are in excess of revenues. For any other activity in a similar situation, the first alternative examined would be whether costs of operation could be decreasesd or revenues increased in such a way that the operation could become profitable. This obvious alternative, however, does not appear to have been considered in any depth in the case of

rail problems (17:80).

Part of the failure to consider such an alternative may be attributed to the premise that if this were possible, the railroads would have already done it. Implicit in this premise is the assumption that railroads know the costs of offering the rail service on the line in question. Railroads clearly know the costs of operation and maintenance for their entire system; however, in the case of a specific branchline, they probably do not know these costs. Therefore, it is unlikely that such an alternative has been considered by the railroads (17:80).

Regarding service level changes, it is possible to view the level of service as defined by service frequency, time spent serving the branch, number of crew utilized, quality of the rolling stock, accuracy in billing, on-time service, amount of damage to products being transported, and a host of other variables. For our purposes, however, three aspects of the level of service are observed. These are (1) frequency of service, (2) hours spent serving the segment, and (3) train crew size (17:81).

Frequency of service is the number of times per week the railroad serves a branchline and as such, could be reduced with a savings to the branchline operation. Shippers are more likely to accept the inconvenience of reduced service as opposed to a complete loss of service

(17:81). Hours spent serving the branch is the amount of time it takes to leave the origination yard, serve the branch, and return to the origin. Crew size, or the number of persons on the train serving the branch, can also be reduced. Depending on where the branch is located, crew size varies from one or two to six in states with full crew laws (17:81).

All modes, including trains, both military and civilian, are used daily for movement of defense supplies and personnel on a worldwide scale. To ensure that our national transportation system is capable of responding during emergency periods, it is exercised during peacetime. These exercise programs range from large scale deployment of combat forces from the U.S. to Europe, to various local exercises conducted within the U.S. or overseas areas (126:47). Thus, another way to increase rail traffic is to utilize rail service more often in the movement of troops and materiel during mobility exercises.

As an example, recent studies of various installation rail facilities (124), including Otis Air Force Base, Massachusetts, which is adjacent to Camp Edwards, indicated that potential outloading requirements of the rail system were greater than existing capabilities. Achieving that capability is severely constrained by, among other factors, trained blocking and bracing crews, and formal outloading plans (14:2). As a result, MTMC is revising AR 55-4, a

joint regulation which requires the services and other Defense agencies to designate installations to report to MTMC their capability to receive and outload cargo. These data, expressed in railcar and truck loads per day, are used to determine the feasibility of CONUS movements supporting military operations plans (93:13) and are an attempt to update the limited surveys conducted in the late 1970s which actively promoted large scale rail deployment exercises to ensure proficiently trained railcar loading personnel (54:60,69).

To a limited degree, this training is accomplished annually with the REFORGER (Return of Forces to Germany) exercises (87:10). During these maneuvers, cadre members of deploying units receive "hands on" training in railcar loading of typical and special unit equipment and in turn, instruct their respective unit rail loading teams (108:8; 98:11). This concentrated training in rail (as well as air) loading supported 54 sorties of C-141 aircraft at Oakland Army Base in 1982 and awarded many participants Air Force Aircraft Loaders certifications (109:10). Units also receive orientation courses in European rail loading procedures (108:8), which are essential when deployed equipment is off-loaded (from the sea mode interface) at Belgian or Dutch ports and reloaded on railcars for movement to German exercise sites (16:14).

William Taylor, President of the Illinois Central Gulf

Railroad, has criticized DOD's annual exercises, however. He noted that the same two U.S. ports, Beaumont, Texas, and Norfolk, Virginia, were always used. As an improvement, he suggested that additional ports such as Mobile, Gulfport, and New Orleans be considered in order to broaden the experience gained from such exercises (95:14).

The Surface and Ports Panel of the Third National Strategic Mobility Conference identified current policy which allows military transportation units to handle DOD cargo during peacetime in order to maximize training. Such realistic training was considered the most effective way to ensure that the active and reserve component units would be able to perform during wartime. This training was also coordinated with industry and labor to prevent competition. For example, labor unions were advised that this policy enhanced training without having an adverse effect on industry and were encouraged to continue supporting military personnel training (95:16).

Other possible sources of increased traffic are those Air Force bases programmed for heating plant conversion from oil/gas to coal, and/or increased delivery of JP-4 by rail. Authorities, however, must also consider the following:

1. Most base rail facilities were built when 50- to 70-ton capacity railcars were the norm. Today 100-ton

capacity rail hopper cars are normally used in coal service, while 20,000- and 30,000-gallon tank cars are replacing the older 10,000-gallon cars. These dated facilities may be inadequate or may require significant upgrade.

2. Increased volume deliveries of coal due to volume rates will warrant expanded coal receiving and storage capability.

3. The adequacy of assigned locomotive power should be assessed, e.g., USAF locomotives were built between 1941 and 1954. As such, the age, size, and/or mechanical condition of assigned power could limit the capability to handle increased coal and/or JP-4 rail traffic (92:5-6).

According to MTMC, the traffic increase analysis (part of the abandonment alternatives analysis) should not be performed by MTMC or by the military service headquarters. Instead, the individual installations should be tasked with providing this information. Recommendations for specific organizational responsibilities and taskings will be provided in Chapter V.

Increased Rates

Another alternative open to the Department of Defense is to accept the carrier's proposed rate increase to keep

the line open. MTMC's Railroads for National Defense (RND) Program is responsible for negotiations and evaluations of carrier proposals to increase shipper freight rates. However, due to the possibility of establishing a costly precedent by allowing rate increases, MTMC does not, as a matter of policy, propose increased rates. This policy also ensures that other alternatives are considered first. Consequently, rate increases should only be considered a last resort.

Off-Base Outloading

The thrust of the previous alternatives was aimed at retention of the existing rail service. The option of outloading off-base at the next available railhead, however, permits a complete or modified abandonment of the rail line. Several negative factors arise when considering the possibility of using commercial facilities as loading sites, including the following (14:40):

1. Increased distance that loading teams, supplies, and unit equipment must travel for loading operations;

2. Increased command and control problems;

3. Added expense of using commercial facilities;

4. Additional security problems.

In addition, technical requirements such as the following

must also be addressed when considering this option:

1. Availability and adequacy of loading ramps and staging areas;

2. Limiting factors such as competition among military units and civilian industry for the use of rail facilities and resources;

3. Switching services available;

4. Number of cars that can be moved out per 24-hour period (123:F-5).

Commercial rail facilities within 25 miles of several DOD installations were surveyed in the late 1970's by MTMC's Transportation Engineering Agency (124:20-24). Those in the immediate vicinity of Otis AFB/Camp Edwards, MA, Fort Campbell, KY, and others were found not suitable for use as supplementary loading sites. These facilities would, however, be highly important during sustained loading operations due to their empty- and loaded-railcar storage capacity. Thus, to ensure that the full capacity could be realized, various sections of track would have to be upgraded immediately (14:40-41).

Whereas the previous abandonment options required the use of either nondefense funds or Defense Operations and Maintenance funds, MTMC indicates that this is the first alternative that would probably require the use of military

construction program (MCP) funds. This is important because the MCP requires a thorough justification and formal analysis prior to project funding. The Abandonment Alternatives Analysis (AAA) is a key portion of the justification and, in concept, is an engineering economic analysis which considers the life cycle costs related to construction, maintenance, equipment, manpower, and the time value of money (71:38).

After this base analysis is complete, it should be forwarded to HQ USAF Directorate of Transportation (LETT) through the appropriate MAJCOM. The analysis report should include a recommendation to proceed with the MCP project, i.e., off-base outloading, or to continue further efforts to retain the needed rail service. After a HQ USAF (LETT) review, the analysis should be forwarded to MTMC (71:39).

With MTMC/DOD concurrence on the MCP project, MTMC will request that HQ USAF initiate formal MCP procedures. If the USAF recommendation was to retain the rail line and MTMC/DOD disapproves, MTMC will inform HQ USAF of the remaining available options, e.g., moving the mission requiring rail service or making offers of financial assistance to the rail carriers (71:39).

Mission Relocation

The seventh option is to move the mission from the

base requiring rail service to another installation which is not threatened by abandonment. For this to be considered, however, the strategic viability of the mission must be retained or improved, and the overall costs to the Department of Defense reduced. To provide higher level (JCS, HQ USAF) decision-making authorities necessary information, MTMC indicates that moving the mission also requires the base AAA. To accomplish this, the following key questions should guide the AAA:

1. What is an acceptable geographical location of the missions?

2. What installations have physical facilities capable of accepting an additional mission(s) with its associated forces and equipment?

3. What additional facilities and/or MCP funding are required and what are the costs?

4. How do the above answers fit into the DOD overall strategic review?

In addition, the ultimate decision-making authorities must consider the political realities/constraints in proposing mission changes from one base to another (71:43).

Financial Assistance

The final option available to retain a defense

essential line is to offer some form of direct military financial assistance to the rail carrier. This can include DOD offers to contract for service, to lease the line, or to purchase the line outright.

After the carrier submits its abandonment application to the ICC, MTMC furnishes a copy to the military service headquarters (AF/LETT). The abandonment application contains the costs of rail line rehabilitation, maintenance, operation, and the carrier's asking price for subsidy or purchase of the connector line. This information is then used to assist the base analysis team in preparing its AAA. Knowing the rail carrier's asking price for subsidy or purchase of the line, the AAA is used to achieve two objectives. First, it provides the relative costs of the options considered, i.e., outload off-base, move the mission, or offer financial assistance (contract, lease, or purchase). Second, the AAA helps to develop an initial counter-offer of financial assistance to the carrier. If the USAF recommendation is for MTMC to extend an offer of financial assistance, the funding source should also be indicated (71:45).

Section 208 of the 1980 Staggers Rail Act authorizes carriers to enter into contracts with shippers, subject to filing with the ICC. As such, the Act seeks to encourage the use of contracts and places strict limits on the

ab lity of the ICC to disapprove a contract. Despite this official encouragement, however, both carriers and shippers have expressed hesitation about entering into contractual shipping arrangements. This hesitation is probably a manifestation of a lack of experience in negotiating transactions on other dimensions besides price and quantity. Thus far, most of the contracts that have been filed are of limited duration and require very little commitment of resources by either party (4:37).

Contracts are an important means of exchange: they are a preferred alternative to spot cash transactions when complexity and need for continuity call for a commitment into the future between the transacting parties. Contracts also have the capability of significantly reducing the uncertainties which in the past have contributed to the high costs of rail transport. Although effective in reducing these uncertainties, it is ironic that in effect, contracting has been discouraged by uncertainties surrounding the contracting process (4:37).

Such trepidation has been justified because contracting for transportation by rail creates problems that are different from that of motor or water transport contracting. These problems are both political and economic and not easily left to solution by market forces. Historically, railroads have distorted rate-making procedures in order to discriminate among themselves or

other modes. Contract rates may remove this incentive and instead provide railroads with a tool to adjust their pricing policies in ways that lead to a more efficient allocation of transportation resources. Furthermore, contracting may act in the place of regulation as a means of protecting carriers and shippers from potential market failures (4:38).

One important type of contract, the contract for service, is used where traffic volumes are low, rail line abandonment is imminent, and the availability of continued rail service is a problem. MTMC's RND Program is tasked with administering contracts for service and as such, seeks the carriers' commitment to retain the line, provide satisfactory service, and maintain the rail line in an acceptable condition. Examples of USAF related contractual considerations are suggested in Statement of Work for Railroad Transportation Services (121) and include the following:

1. A minimum of two persons, one meeting the qualifications of Civil Service Job Standard WG-5737, Locomotive Engineer, and one meeting the qualifications of Civil Service Standard WG-5736, Brakeman and Conductor, are required at all times during locomotive operation;

2. The contractor is required to provide services during periods of increased or reduced operations when

directed, e.g., preparation for deployment under mobility exercises may require increased activity within this function;

3. The contractor shall be responsible for maintaining all transient U.S. Government-owned railway equipment temporarily held at the activity;

4. The contractor will, in coordination with the TMO, Freight Section, determine the placement point of railcars received for loading/unloading;

5. The contractor must support requirements from Host-Tenant and Inter-Service Support Agreements as specified by individual bases.

In spite of a few shortcomings, rail contracts offer meaningful opportunities for shippers and railroads to organize their relationship in a flexible, efficient, and mutually beneficial manner. Because contracting's failure can lead to new calls for regulation, the encouragement of practices that contribute to its success should be an important policy objective of any transportation manager (4:42; 29:57).

Abandonment Impacts

The impact of rail service cessation or curtailment on branchlines (primarily rural) is a topic of great

controversy. This controversy stems from the technical procedures used to assess the community impact of the loss of rail services. Regardless of the method of evaluation used, however, when rail service is terminated on a branchline, communities along the line will suffer some loss of jobs, income, taxes, and potential future development of rail-related industries (17:22).

When a rail line is abandoned each of its users must choose between one of three courses. These are (1) utilization of alternative means of transportation for commodities previously carried by the line, (2) relocation to another site having rail service, or (3) cessation of at least that portion of business involving use of rail services (83:A-2). Selection of a course of action by each user is influenced by many variables including, among others, the availability and cost of alternative transportation compared to rail service at the user's original site, the availability of suitable alternative sites, the user's market area, the amount of investment that would be required at a new site, and the profitability of the business (83:A-2).

There are numerous potential impacts that a rail line abandonment can have upon local communities, including military installations and facilities. However, these impacts can be classifieid into six general categories. These are as follows: (1) transportation rates; (2)

adequate service; (3) employment; (4) community/regional development; (5) energy conservation; and (6 environmental protection (81:276-78). To provide further understanding and appreciation of the rail abandonment problem, each of these impact categories will be reviewed below. While each of the categories are primarily civilian community related, they are also applicable, either directly or indirectly, to military installations. As such, correlations and similarities of impacts among both civilian and military communities will also be discussed. After a review of the general impacts, case study impact reviews of nineteen military facilities will be highlighted.

Transportation Rates

Few of the commodities carried by rail could not in theory be transported by other modes. There are some notable exceptions, such as very large electric generators, transformers, over-sized military hardware, etc., but movement of such commodities is relatively rare. In general, therefore, if a firm or government agency is said to be dependent on rail for some portion of its transportation needs, what is really meant is that the cost of using alternate modes of transportation is prohibitively high (83:A-2). As such, the impact of transportation rates is extremely important.

The impact of increased rail abandonments on rail

rates is uncertain. If increased branchline abandonment results in consolidating traffic on fewer lines, such that economies are realized, rates may actually go down (81:277). On the other hand, if the rail abandonment policy is accompanied by upward rate flexibility, shippers may be willing to pay higher rates to retain rail services on low-density lines, and fewer abandonments may be necessary. Consequently, what is relevant is not that rates would increase or decrease, but rather that railroads would no longer be forced to operate lines where rates are below cost (81:277).

The question of whether some low-density lines have the potential to become economically viable depends on railroad cost characteristics and the elasticity of demand for transport of the affected commodities. If demand is relatively inelastic, raising rates might generate increased revenues for railroads; conversely, if demand is relatively elastic, raising rates would result in lower revenues. One author (81) who raised the issue observed that it is mostly bulk commodities (including military) which originate on branchlines, while processed or finished goods originate on mainlines. The service advantage of shipping by truck rather than rail is much less important to shippers of bulk commodities than to shippers of processed and finished goods. Therefore, the demand for rail service by shippers of bulk would tend to be less

elastic, i.e., bulk-commodity shippers would be less inclined to shift to motor carriage than shippers who valued the service advantages associated with motor carriage. Consequently, there is a possibility that increased rail rates on some low-density lines would generate sufficient revenues to continue service (81:277).

For shippers who do shift from rail to truck as a result of rail abandonment, an issue is whether they face higher or lower rates following the shift. It should be noted that motor carriage offers service advantages over rail. Even where truck rates are higher, it does not necessarily imply that a shipper's total logistics costs are higher as a result (81:277).

Case studies of rail abandonments offer mixed evidence of rate impacts. A study of the impacts of Midwest abandonments (the "hot spot" for present and future abandonments) following the 4-R Act revealed that in the majority of cases the truck rate substituting for abandoned rail service was lower than the rail rate at nearby grain elevators (106:11). In addition, only two out of 40 elevators affected by the abandonments closed as a direct result of abandonment (106:15). An Association of American Railroads (AAR) review of a number of retrospective abandonment studies also found that in many instances, shippers forced to switch to motor carrier discovered a resultant reduction in shipping costs (81:277).

Other impact studies, however, reveal quite a different story. For example, a coal line abandoned in Kentucky forced a number of small coal producers out of business. The producers were unable to compete because of increased transportation costs of shipment by truck and because the abandonment occurred during a period of low demand for coal (17:36). Other studies involving agricultural, forest products, and mineral industries have found similar results (17:36; 43:5-1; 6:12).

Adequate Service

Where truck rates are so much higher than rail that the shipper cannot afford to use truck service and continue a profitable business, adequate service would be eliminated as a result of abandonment policies. There is some evidence, however, as cited above, that instances of lower-cost truck service have resulted from rail abandonment with resulting expansion of affected businesses. Unfortunately, this is not the general rule, i.e., abandonments usually result in a decreased level of service, especially for bulk commodity customers such as the military or agricultural interests. The Department of Transportation (DOT) has made predictions as to which industries would be most afffected, in terms of adequate service, by eased rail abandonment.

Agriculture was considered the most affected. Lumber and wood products would be moderately affected, and affected to lesser degrees would be food and related products, chemical and allied products, and petroleum and petrochemical products (62:164-180; 17:277). Unfortunately, military needs were not considered.

Employment

The impact of rail abandonments on employment is also mixed. For instance, the AAR found that the highway network in rural areas allows workers to commute substantial distances to new employment opportunities, and that low density abandonments have had no significant impact on employment (81:277). In addition, the National Transportation Policy Study Commission (NTPSC) Special Report No.1 cited the employment impacts of rail abandonments as not potentially serious except in those communities with a concentration of rail employees, and even in those communities decreases in rail employment are likely to be compensated by increases in trucking employment (81:278).

Other studies reveal significant adverse (especially short-run) effects on employment as a result of abandonment. For example, 30 people were laid off by Camp Milling, a grainery, as a result of abandonment by the New York, Ontario, and Western Railroad. As a result, serveral

of the railroad employees were also laid off due to decreased business; thus, a multiplier effect resulted (2:57). Additional studies found similar effects, with small towns having one or more heavy rail users suffering the most (17:37). Despite the seemingly contradictory evidence, it appears safe to say that, in general, rail abandonments will produce some job reductions (17:35).

While not directly affecting military installations, the employment issue can become a concern for the DOD. As potential civilian employees are forced to leave the community because of the abandonments, fewer people are available in the local community's labor pool, thereby decreasing the manpower resources which may be needed by the military facility.

Community/Regional Development

The projected impacts of increased rail abandonments on employment have implications for community growth and economic development. The AAR's review indicated that abandonment of branchlines has had little or no impact on economic development of the affected communities (81:258). Also, a survey of 71 abandonments in Iowa revealed little effect on employment and business or community growth (81:258). However, of the 153 towns in Iowa under populations of 3,000 gaining new industry, only 0.9 percent were not served by a railroad (45:5-9). In addition, of

2,616 firms in 223 product classes which showed the greatest expansion during the 1960's, 40 percent stated that scheduled rail service was of critical or significant value as a plant site feature for industrial locations (45:5-9). These studies indicate that community or regional development is likely to continue for an area without rail service; however, this lack of service certainly places the community at a disadvantage with respect to those communities possessing rail service, all other factors being equal.

As one might expect, this possible lack of community development can also have an effect upon a local military base. A principal effect could be the hinderance of achieving certain federal government or DOD socio-economic or political objectives, such as the awarding of contracts to small or minority businesses in the community. That is, without the continued growth and development of the local community, the base of suppliers from which the military has to choose could diminish.

Energy Conservation

Energy impacts of rail abandonments relate directly to fuel consumption and fuel efficiency of the mode providing the transportation service. On the national level, for example, fuel utilization and efficiency favor railroads over trucks. For every 1,000 net ton miles, rail uses 4.2

gallons while truck utilizes 15.5 gallons (17:41). These estimates are based on many assumptions and aggregated data, and thus may change radically when the fuel efficiency for truck and rail is examined on branchlines.

For branchline operations, the DOT has found truck transportation more fuel efficient for total payload shipments of less than (1) 132 tons, and (2) a distance of 15 miles. Rail is generally more fuel efficient when four carloads (approximately 176 tons) are to be moved more than 10 miles at one time (17:41). Other studies also indicate the need to evaluate specific conditions before actual energy impacts can be determined (81:278; 43:2-33; 44:3-1; 94:46). Therefore, the trade-offs between rail and truck must be carefully examined in each branchline situation to obtain a realistic estimate of fuel efficiency. In addition, with budget pressures and constraints placed upon the DOD, fuel consumption issues are an important consideration and should, therefore, be thoroughly analyzed.

Environmental Protection

There are three main potential sources of environmental degradation associated with rail abandonments; these are (1) air emissions from rail and trucks, (2) noise pollution from rail and trucks, and (3) increased need for highway maintenance and construction

(81:278). The Public Interest Economic Center (PIEC) found in their studies that each of these impacts were relatively insignificant as a result of abandonment and shift to truck transportation (81:278; 17:38). Others, however, have found them to be more important (17:41; 94:51; 43:xv).

For example, every year American industries and transportation vehicles emit approximately 90 million tons of air pollutant mass emissions into the environment (17:41). About 1 percent of this total (.92 million tons) is contributed by railroads in the form of carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx), and others. Trucks have contributed a generally greater amount (1.74 million tons) of air pollutants. When the percentage of the national total tonnage hauled by rail (41 percent) and by truck (21 percent) is considered, the relative percentage of air pollutants emitted by truck becomes even more significant (17:41).

Specific Military Impacts

To conclude this section on abandonment impacts and also the literature review, statements and/or studies relating to Air Force installations considered to be potential rail line abandonment candidates, i.e., those on light density lines, will be reviewed. Each of these statements were directed by HQ MTMC, prepared by the

specific USAF installation, and finally coordinated/approved by the appropriate MAJCOM and HQ USAF/LETT. In addition to the 17 Air Force installations, two other military bases are considered by HQ MTMC to be extremely important and, therefore, will also be reviewed. These bases are Fort Campbell, Kentucky, and Camp Pendleton, California.

Fort Campbell KY. The Illinois Central Gulf Railroad (ICG) case involving Fort Campbell is extremely important because it was the first time Section 401 of the 1976 4-R Act was tested. This section of the 4-R Act gave the Department of Transportation's Federal Railroad Administration (FRA) authority to help railroads negotiate mergers, consolidations, and reorganizations regardless of antitrust implications. In addition, it is the first test of the "defense essential" and "public interest" argument used to prevent the abandonment of uneconomically feasible connector lines (68:3-B). As a result, the case has generated considerable military interest and has been used by MTMC as a test case/precedent to evaluate other abandonment cases scheduled to appear before the ICC (86:1; 72:1).

To provide a brief background, in May 1980, the ICG gave notice of its intent to file with the ICC an application for a certificate of public convenience and necessity permitting the abandonment of a line of railroad

from Hopkinsville, KY, to Nashville, TN, a distance of 74.76 miles (47:2). Trackage of the Army installation at Fort Campbell, however, connects with the ICG line at Edgoton, KY, approximately 16 miles north of Hopkinsville.

Fort Campbell is a mobilization station for the 101st Airborne Division, the 42nd Infantry Division, the 76th Training Division, and additional forces of batallion size (47:5; 51:2). These units have a total of approximately 24,000 vehicles, including tracked vehicles, artillery pieces, and larger engineer equipment. In addition, combat tanks of units mobilizing at other stations will be processed through Fort Campbell. The load capacity limitations of the nation's highways, bridges, and pavements prevent such equipment movements by truck. Regarding the air mode, the nonavailability of necessary airlift assets prevents their movement by that mode (47:5). As a result, the DOD considers rail service essential to the accomplishment of Fort Campbell's assigned mission (47:6).

In terms of rail traffic shipped and received at Fort Campbell, five year figures from the DOD are presented in Table 3 below:

TABLE 3
Ft. Campbell Rail Traffic

	1975	1976	1977	1978	1979
Total Carloads	215	1633	325	615	192
Total Tonnage	4654	20637	4986	11866	1959

The large increase in 1976 was the result of traffic generated during the return of forces to Germany (REFORGER), a military exercise to test Fort Campbell's mobilization/deployment capabilities (47:6).

While there appears to be a decrease in rail usage in 1979, Fort Campbell is scheduled to convert its heat and generating plant from use of gas and oil energy sources to coal in Fiscal Year 1985. As a result, projected coal usage is forecast at 140,000 tons per year or approximately 1,650 additional railcars. In addition to these factors, the Department of the Army initiated a study to determine the feasibility of outloading at several different off-post rail sites. Their study determined that this alternative would require additional manpower and equipment, and compounded problems of safety, communications, rail site security, construction, and loading site resupply (47:7). Furthermore, it was found that outloading off-post would double the required deployment time. As such, the Army concluded that there were no feasible alternatives to direct rail service to

Fort Campbell.

Despite the Army's studies, the DOT stated before the ICC (50:14-15) that "it is questionable whether the reference to national defense is sufficient to override the other national transportation policy considerations," i.e., maintaining an economical, efficient, and viable rail system. The DOT also reasoned that to the extent that a rail carrier is forced to operate at a loss, its ability to provide continued service to the general public or a particular military facility is threatened. That is, if carriers are not allowed to earn adequate revenues, the long range impacts could mean a reduction in service which would threaten the nation's overall ability to mobilize troops and equipment (50:15). Therefore, the DOT concluded that the abandonment of rail service to Fort Campbell does not contravene the national transportation policy. In conclusion, the case has progressed through the various ICC abandonment steps. The current status includes the Army holding a "five-year option to buy" lease with the rail carrier (127).

Camp Pendleton CA. The abandonment case involving the Marine Corps Base, Camp Pendleton, CA, is also important because it revealed that rail carriers may attempt abandonment for other reasons than simply light density. In this instance, for example, the Atchison, Topeka, and Santa Fe Railway Company (AT&SF) filed an

application with the ICC on 30 September 1980 to abandon 16.54 miles of railroad in the Fallbrook District (including Camp Pendleton) due to sustained extensive storm damage in early 1980 (46:2; 52:1; 48:2). One section of two miles was completely destroyed and other sections also suffered serious damage due to washouts. As a result, the AT&SF determined that the expenditure of funds necessary for reconstruction and rehabilitation would be improvident (52:1).

Like Fort Campbell, Camp Pendleton was also considered defense essential by the DOD. Camp Pendleton is the main training base for the Marine Corps on the west coast of the United States and also garrisons a substantial portion of the Marine Corp's combat forces (46:5). The 1st Marine Division and other Marine forces located at the base also maintain large volumes of oversize/overweight equipment such as combat tanks. In addition, the Naval Weapons Station (NWS), Fallbrook Annex provides ordnance support for Marine Corps combat units and air-launched weapons support for the Naval fleet. As a result, in the event of contingency, large volumes of ordnance would be shipped from Fallbrook Annex (46:5).

Further, a deployment of the 1st Marine Division would require approximately 2,400 rail cars over a 10-day period (46:5). As a result, there is little likelihood that motor resources could be secured in the required time frame. In

addition, load capacity limitations of the nation's highways could prevent movement by motor carrier. Consequently, rail service is considered by the DOD to be essential to mission accomplishment. After abandonment proceedings, the ICC issued a decision 16 March 1981 allowing abandonment of the line by the AT&SF. At the present time the Department of the Navy is negotiating with the AT&SF for purchase of the line for one dollar; however, approximately $1 million is needed to rehabilitate the line (46:6; 11:1-2; 49:6-7).

Altus AFB OK. Rail service is the contingency mode for receipt of JP-4 fuel. As such, the Military Airlift Command (MAC) considers rail service to be of vital importance to the 443rd Military Airlift Wing stationed at the base. Rail movement of fuel will be necessary in the event of a truck strike or other emergency situation. Also, in the event of U.S. forces mobilization, demand for aviation fuel could increase beyond the capability to receive by truck. Therefore, rail service at Altus AFB is essentially a contingency requirement (102:1).

Arnold Engineering Development Center TN. The Air Force Systems Command (AFSC) considers rail service mission essential at Arnold EDC due to the following unique commodities moved by rail: (1) MX Stage I and IV for test firings; (2) rocket motors for test firings; (3) wind

terminal test items; (4) 120-ton cranes for installation at the center; and (5) JP-4/5 and rocket propulsion fuels, both solid and liquid (38:2). HQ USAF/LETT also included funds to purchase the line (if required) in their budget process (38:1).

Carswell AFB TX. The Strategic Air Command (SAC) views the possible loss of rail service at this base as having a direct impact on the deployment of units in support of mobility and contingency requirements. In addition, Carswell is negotiating with a local petroleum refinery to convert from the present tank truck delivery to tank car, or a combination of both. This conversion back to tank car is estimated to reduce base fuels management manhours by approximately 30 percent (15:1-2).

Ellsworth AFB SD. This facility is currently experiencing abandonment action by the Chicago and Northwestern Railroad (C&NW). As a result of the base's sensitive mission, some of the material pertaining to Ellsworth is classified. However, enough information exists to provide adequate coverage of the impacts resulting from possible abandonment.

As with Altus AFB and others, rail service at Ellsworth is essentially a contingency requirement. Also, service is considered important due to the limited availability of substitute service resulting from the

base's remote location. In addition, the possibility exists for base heating plant conversion to coal. Considering this rather weak justification, HQ SAC considers line abandonment acceptable, with the rail banking concep' preferable, i.e., the rail carrier providing maintenance on the right-of-way in the event of future need (88:1; 27:1; 26:1).

Grand Forks AFB ND. Rail service at Grand Forks AFB serves as a major backup system to air for transport of missiles. In addition, the base is being considered as a possible base for the newly developing MX missile and, therefore, may require rail service. Other commodities received by rail have also included furniture, food, vehicles, fuel, and missles. Further, Grand Forks has been identified as an alternate recovery base for space shuttle vehicles which would also require rail service (33:1-2).

Hill AFB UT. This base is designated as an aerial port of embarkation (APOE). As such, it is not only an onload location for unit deployment, but also represents a significant portion of the CONUS APOE capability for airlifted resupply, retrograde cargo, and replacement/filler personnel. The capability now provided by rail, road, and pipeline is considered necessary to maintain an orderly flow of resources through the base. Loss of rail service would restrict the flow of commodities into this port, resulting in the possible delay of forces

and supplies in a contingency (102:2).

Loss of rail service at Hill would also have an adverse impact in support of the present Minuteman missile and proposed MX missile. Many of these weapon system components are outsize and require rail access. In addition, Tooele Army Depot has a tenant rail engine and heavy rail equipment rebuild facility at Hill AFB, which is the only DOD operated facility of its kind. Rail line abandonment would terminate this facility and, therefore, indirectly impact all DOD rail activities (132:1).

Kirtland AFB NM. With the exception of two spurs, all rail lines are the property of the Department of Energy (DOE) and are considered vitally important to their mission. Although fuels movement by rail is minimal for the base, rail is used for shipments of special and national security weapons and components. In addition, the 3098th Aviation Depot Squadron (AFLC) also utilizes rail to ship/receive classified Class A material. Finally, government contract operations are supported by rail and include the DOE, Sandia Laboratories, and Dyna Electron. As such, MAC and DOE both consider rail service essential (102:1).

Loring AFB ME. In addition to Ellsworth AFB, Loring AFB is also currently experiencing abandonment attempts by the rail carrier. In this case, the Bangor and

Aroostock Railroad (BAR) is seeking to abandon a 16-mile section of track from Carribou to Loring (56:1).

Should the line to the SAC base be abandoned, numerous impacts have been revealed by both SAC and the base. For example, coal is received exclusively via rail and the MCP central heating plant project includes considerable investment for a railcar unloading facility. Annual tonnage is presently 27,500 tons and is expected to increase to 32,500 tons by 1984. Estimated costs to receive the coal by truck is an additional $250,000 annually (125:1). Also, rail offloading and truck transfer facilities at the base would have to be contracted and the double handling of coal would create additional costs, as well as subsequently reducing the BTU value of the coal. Other commodities received by rail include jet fuel from Ashland, Kentucky, salt, anti-freeze, and building materials and supplies (61:1; 125:1). As a result of these impacts, the Air Force is working vigorously to avoid abandonment.

Malmstrom AFB MT. The line to Malmstrom was previously proposed for abandonment; however, a competitor purchased the line, thereby avoiding abandonment (127:3). Nevertheless, the potential still exists for abandonment due to light density traffic.

At present, rail service at the base is used to move

oversized missile components six to eight times per year. As a result, alternate modes are not feasible. Additionally, the FY 83 MCP contains funding for a new coal-fired central heating plant replacing the present oil facility. When the plant becomes operational, approximately 36,000 tons of coal will be required by rail annually. Finally, rail service is also used as a backup to the facility's pipeline fuel movement (63:1).

McGuire AFB NJ. McGuire AFB is the only Air Force installation thus far to actually lose rail service. This abandonment was approved 30 March 1982 (40:1). Although abandonment occurred, McGuire and MAC continue to maintain that the need exists for rail service to the base. Indeed, the case seemed to favor retention of rail service at the facility, as evidenced below.

McGuire is scheduled to convert their central base heating plant from natural gas and oil to coal for MCP 87, with a requirement of 40,000 tons of coal required annually (58:1). The base is also a designated APOE, with military units, along with their equipment, scheduled to arrive at the base for airlift to areas of world tension (102:1). Many of these units depend upon rail service for a significant portion of their surface movement. Rail service was also the backup system for pipeline delivery of JP-4 jet fuel. Despite these impacts, HQ USAF/LETT considered the line non-essential and permitted uncontested

abandonment by Conrail (102:1).

Minot AFB ND. Abandonment at Minot AFB, according to SAC, would have a severe impact on the base's fuels activity. More than 15 million gallons of jet fuel are received annually by tank car. A complete shift to tank truck would result in increased manpower costs. Heating plant conversion from oil and to coal was scheduled for FY 83; however, this program has now been placed in indefinite status. Should the conversion take place an estimated 30,000 tons of coal will be required annually (74:2).

Moody AFB GA. Moody AFB is the only Tactical Air Command (TAC) base served by a light density line. Presently, fuel is delivered by motor carrier under a one-year contract negotiated by MTMC and the Defense Fuels Supply Center (DFSC). HQ TAC indicates that, subsequently, the Southern Railway has submitted new, more competitive rates. In addition, base mission changes will result in an increase in assigned aircraft and a corresponding increase in fuel consumption to approximately 2.7 million gallons per month (59:1). The 347th TFW at Moody is also a component of the Rapid Deployment Joint Task Force (RDJTF)/Rapid Deployment Air Force Forces (RDAFFOR), and as such requires pre-positioned and ready reserve fuel resources. Without rail capability, for larger deliveries and for a potential requirement for rail tank car storage

on base, construction of a significant amount of additional munitic s storage capability would be required for contingency purposes (59:1).

Otis AFB MA. The line serving Otis AFB also experienced abandonment by the carrier; however, the State of Massachusetts intervened and negotiated with Conrail for continued servic .. :1) . The principal impact of lost rail service to the base would be the base's reliance on rail for approximately 12,000 tons of coal annually for its heating plant (99:1; 12C:1). However, during contingencies approximtely 900 railcars would move from adjoining Camp Edwards within a five-day period. Army commodities requiring movement include combat tanks, armored personnel carriers, and engineering equipment (99:1).

Pope AFB NC. Rail is the primary mode for receipt of aviation fuel at the base. An average of eight 20,000 -gallon tank cars are received daily with a weekly average of 640,000 gallons. Pope AFB is the airlift support base for nearby Fort Bragg. Fort Bragg transportation officials also control the rail lines at Pope AFB and the local area through a joint agreement (102:1).

Tinker AFB OK. Tinker AFB is also a designated APOE; therefore, most of the same impacts/concerns listed for Hill AFB also apply. However, Tinker AFB has other

concerns about the movement of ammunition to the base from the Army Ammunition Depot at McAlester, Oklahoma, during a contingency. The connecting east/west rail line between these points is not presently part of STRACNET; however, continued operation of this line is considered by HQ AFLC as important as the continued operation of the rail connector to Tinker AFB itself (132:1). The base is also scheduled to deploy significant amounts of outsized Army equipment which requires rail movement.

Vance AFB OK. Although originally listed as a defense installation requiring rail service, correspondence in April 1982 from the Air Training Command (ATC) indicated that abandonment of the rail line from Arkansas City, Kansas, to Enid , Oklahoma, would not have an impact on mission requirements for the base (40:1). Therefore, ATC would not contest any abandonment attempt by the carrier.

Wurtsmith AFB MI. Rail service at Wurtsmith AFB is primarily for contingency purposes. At present, all JP-4 fuel is received by pipeline. The storage area for the base's pipeline fuel is supplied by barge and is therefore subject to severe weather on Lake Huron. Consequently, the DFSC regional office has requested that rail be maintained as an option for fuel delivery (131:1). Wurtsmith AFB is also scheduled for conversion of its heating plant to a coal-fired facility in FY85-86, thus requiring increased need for rail service. Finally, rail is used occasionally

for movement of munitions/weapons, deployment of units, movement of specialized items, and government contract operations (131:1).

Summary

Alternatives to civil rail line abandonment have been suggested by MTMC and many of them have been used in contemporary industry. In addition, the impacts of actual abandonments have been studied in the civilian community and forecasted for the military sector. Although varied, the severity of the military situations associated with potential rail abandonments should be significant enough to focus increased attention on the civil rail line abandonment issue.

CHAPTER III

METHODOLOGY

Overview

According to rail engineering officials with the Military Traffic Management Command (MTMC), an important area of concern for the Air Force (and the other military services) should be defining/determining the essentiality of rail service in meeting the assigned missions of each of its installations (85). However, due to the relatively recent attempts by rail carriers to abandon unprofitable lines, the Air Force has not viewed the "mission essentiality" definition as critical. Consequently, USAF still lacks formal procedures for evaluating the importance of rail service at each of its bases. The objective, therefore, of this study is to develop a formal structure for determining this importance or essentiality. Additionally, a further aim of the study is to recommend responsibilities to various base, MAJCOM, and HQ USAF organizations for effectively analyzing the eight MTMC abandonment alternatives (22). The overall result of this effort will be the development of a formal decision methodology to be used by appropriate USAF officials.

Determining Mission Essentiality

Criteria Development

To begin the development of the essentiality definition, an extensive review was conducted of the 17 USAF installations served by light density rail lines. Also, two other "significant" military case studies identified by MTMC were reviewed. These 19 military facilities and the impact of abandonment upon them were discussed in Chapter II. In addition to the review of the military installations, the impact on civilian communities was also explored.

From these case studies and literature reviews, a list of important factors or criteria for rail service retention was derived. These criteria were then incorporated into a survey instrument for conducting telephone interviews with logistics professionals at each of the CONUS MAJCOMs and at HQ USAF.

To validate the survey instrument and criteria, a trial test was conducted with the Deputy Head, Department of Logistics Management, School of Systems and Logistics, Air Force Institute of Technology (76). To further validate and improve the questionnaire, personal interviews were also conducted with HQ Air Force Logistics Command

(AFLC) logistics planners and rail officials (129). After this initial validation phase, decision-making officials in the remaining MAJCOM and HQ USAF logistics plans offices (LGX) were surveyed to gain an Air Force-wide consensus on the appropriate factors or criteria included in the survey and to establish the relative importance of these criteria. It should be noted that while the subject of this thesis deals primarily with transportation issues, only logistics officers across the MAJCOMs and at HQ USAF were questioned. This was an attempt to achieve a broader perspective and view of the topic, and to avoid the possibility of bias and parochial interests that might exist among transportation officials. The final validated opinion survey is found in Figure 1.

Survey Techniques

As indicated, each of the CONUS MAJCOMs and HQ USAF logistics plans offices were questioned to validate the various factors considered in retaining rail service to USAF bases. Additionally, each of the officers were asked to rate each of the factors as to their importance in determining base rail service retention. Through the computation of average response scores, this also revealed a general assessment among higher-level logistics officials regarding rail service's overall importance to the Air Force.

FIGURE 1

Professional Opinion Survey

Objective

Determine the essentiality of rail service in meeting the Air Force mission, including wartime and peacetime.

Question

What rating would you place on the importance of each of the following criteria or factors for retaining rail service to individual Air Force installations? Use a scale of 1 to 9 with 9 meaning highly significant and 1 indicating not significant.

Criteria

1. The base is an aerial port of embarkation (APOE).

2. The base is a storage location for pre-positioned assets, e.g., Seymour Johnson AFB vehicles.

3. The base heating plant has been converted to or is scheduled for coal conversion.

4. The connector line abandonment could reduce the size of the available civilian labor pool for employment at the base, due to possible loss of community businesses.

5. The connector line abandonment could result in a potential decrease in the number of suppliers to the base, e.g., meeting certain federal government socio-economic and political objectives such as contracting with small and minority businesses.

6. Other modes cannot be substituted for rail.

7. The use of rail is more cost efficient than other modes.

8. The use of rail is <u>not</u> more cost effective than other modes.

9. The use of rail is more fuel efficient than other modes.

FIGURE 1 (continued)

10. The use of rail is not more fuel efficient than other modes.

11. The increased use of trucking would have detrimental environmental effects such as increased air and noise pollution, and road maintenance and construction costs.

12. The increased use of trucking would not have detrimental environmental effects.

13. The use of trucking would result in increased transportation rates.

14. The use of trucking would not result in increased transportation rates.

15. The timeliness of service.

16. The non-availability of off-base outloading facilities within a reasonable distance.

17. The availability of off-base outloading facilities within a reasonable distance.

18. The potential for increasing traffic to at least 5 million tons per mile annually, e.g., incoming coal shipments and training exercises utilizing rail.

19. The inability to move the base's mission to another location.

20. The non-existence of a POL pipeline or barge for POL movement.

21. The presence of political influences, e.g., DOD, Congressional, local community officials/authorities.

22. The potential for the base to allow the carrier to increase rates to the carrier's breakeven point, given that this is considered by MTMC a last resort for policy reasons.

23. List any other factors which you consider important.

Scaling and interviewing methodology. There are various scaling systems which can be used to record the intensity of differences on professional opinion surveys. One researcher and his associates compared 25 scaling techniques and found that, on the whole, the best results were obtained with the 1 to 9 scale (1:282). As a result, the same scaling system was employed for this study, with a criteria rating of 1 considered insignificant and a rating of 9 viewed as highly significant. As such, the range of ratings between 1 and 9 represent various degrees of importance (unimportance) of the surveyed criteria.

Each logistics expert was instructed to answer as precisely as possible. However, whenever an undecided situation occurred, such as "I would rate that criterion as 5 or 6," the average of the two rates were used. Thus, in this example the accepted rating was 5.5.

There are also different methods for conducting interviews, e.g., physically assembling the entire sample population in one room or by means of a telephone conference network, or interviewing each sample member individually. However, to obtain judgements from individual professional group members and to combine these individual judgements into a group decision, it was necessary to utilize a process which minimized error and bias.

Huber and Delbecq (42) studied this problem and reached several conclusions. First, interacting groups (groups where communication is verbal and more-or-less spontaneous) have been shown to inhibit individual judgement and to exercise considerable impact by increasing errors in final group outcomes due to social-psychological phenomenon which are impossible to "control out" (42:35). Therefore, group processes which incorporate independent member judgements reduce errors and bias. Second, the use of arithmetic means have greater accuracy for aggregated individual judgements (42:45). The use of simple majority rule is dysfunctional when judgemental accuracy is the overall criterion. Finally, regarding the number of judges to select, their research suggests that strategic benefits are obtained by having at least five (5) professional judges, but the benefit of increasing beyond ten judges is modest (42:44).

In light of Huber and Delbecq's findings, this study incorporated each of the previous conslusions. For instance, ten experts (nine CONUS MAJCOMs and HQ USAF) were selected to participate in the survey. Also, each questionnaire respondent was surveyed independently and an arithmetic mean or average was used to derive the overall ratings of each criterion.

Survey and interview rules. Regarding survey item 23, "List any other factors which you consider important,"

the following rules applied:

1. Some respondents indicated additional areas of consideration;

2. Those additional criterion mentioned only once were not accepted as valid and were, therefore, disregarded;

3. Those additional criteria mentioned most frequently were analyzed to determine if their inclusion in the survey was appropriate;

4. If an additional criterion was included on the survey, those respondents who had already completed the survey were recalled to rate the new items and those respondents who had not yet been contacted received the additional questionnaire item.

Additional areas of importance were those criteria rated so low as to remove them from essentiality consideration. As such, the criteria with an average rating below five (5) were subsequently excluded from the survey, and therefore, from consideration in the essentiality decision.

Data Compilation

Arithmetic mean. A matrix of the criteria ratings was devised such that the last column was the average

across the experts for that criterion. The terms and formulas involved included:

Rcj = the rating given by expert j to criterion c;

RS = the sum of expert j's ratings;

Ac = the average rating of criterion c;

where,

$$RS = \sum_{c=1}^{m} Rcj;$$

$$Ac = \left(\sum_{j=1}^{n} Rcj \right) \div n;$$

n = the number of judges;

m = the number of criteria.

Indexing. After the criterion rating average (Ac) was computed, the sum of these averages (AS) was determined such that:

$$AS = \left(\sum_{j=1}^{n} \sum_{c=1}^{m} Rcj \right) \div n, \text{ or}$$

$$AS = \sum_{c=1}^{m} Ac.$$

The results of the above calculation were used to derive an "essentiality coefficient" (EC) for each criterion c by the following method:

$$ECc = Ac \div AS$$

The essentiality coefficient is simply an index or

composite of two or more other numbers. Such a quotient helps to succinctly summarize numerous observations and to reduce raw data (Ac) to a manageable form. Expressed as a decimal, this relational index provides use and comparison of otherwise non-comparable numbers (55:151). In addition, the essentiality coeficient is quite similar to the abandonment indices assigned by Boske and Wolfgram in their "social decision-making framework" studies (10:80).

Binomial system. When an Air Force base is threatened by rail service abandonment, appropriate base personnel/committees will answer "yes" or "no" to each of the 22 essentiality criteria previously mentioned. Similar to the binomial probability distribution (55:187), if the base's mission includes a particular criterion, it is assigned a value of one (1). Conversely, if the criterion is not applicable to the base's mission, it is assigned a zero (0). After assignment of the value, it is mulitplied by the essentiality coefficient to produce an "essentiality factor" (EF) for each criterion:

$$EFc = (0,1) \times ECc.$$

Kerlinger's binomial formulas (55:187) were adapted to produce a sum of the essentiality factors. This produced an individual Air Force base "essentiality score" (ES) such that:

$$ES = \sum_{c=1}^{m} EFc.$$

The individual ES obtained by an Air Force base facing possible rail service abandonment is then compared to the standard Air Force "comparative essentiality score" (ES*). Depending on where the individual ES falls in relation to the standard ES*, the base officials will make a decision whether to allow abandonment of its rail service, i.e., the essentiality of rail service to the facility is finally determined.

ES* development. To determine the comparative essentiality score (ES*), Chapter IV of our study examines the following three categories of military installations:

1. Two USAF bases which have previously completed the abandonment process;

2. Two non-USAF bases which have already completed the abandonment process;

3. Two USAF bases which are presently involved in the abandonment process.

Although two current abandonment cases were reviewed, our evaluation efforts focused on those abandonment cases that have been completed. This is due to the availability of more extensive abandonment data in the form of analyses and studies. That is, examination of a base that is currently or potentially threatened by abandonment would

require extensive cost studies and impact analyses, both of which are not available for this study.

Thus, we reviewed the files of selected bases and produced a yes/no (1, 0) matrix for the essentiality criteria. If a criterion was not mentioned in the background literature or specific case studies for that base, the criterion received a value of 0.5. This allowed for the possibility that the criterion might have been considered, but we either did not have access to the necessary information or the information was incomplete. This lack of complete information was not construed as indicating a lack of criterion consideration, but merely the lack of information available for our research. This is highly analogous to actual decision-making where all or perfect information will not be available. Although somewhat limited, this method should facilitate the initial mission essentiality decision and focus interest on those areas where additional research is warranted.

Weighting and ranking. In addition to the Huber and Delbecq study, we employed a weighting scheme developed by Echenrode (25) to rank the criteria according to their relative importance (RK). Although ranking the criteria has no direct effect in determining the mission essentiality of rail service, this procedure was introduced to provide information needed to analyze selected case studies in Chapter IV. Also, the rankings may provide a

basis for further research in the area.

The raw rating assigned by the experts to each criterion (Rcj) against the 1 to 9 scale was carried two significant figures and formulated as follows (25:184):

Wcj = the weight computed for criterion c from the rating given by expert j;

Wc = the overall weight of criterion c;

where,

$$Wcj = Rcj \div \left(\sum_{c=1}^{m} Rcj \right), \text{ or}$$

$$Wcj = Rcj \div RS;$$

$$Wcjn = \sum_{j=1}^{n} Wcj;$$

$$Wcjm = \sum_{c=1}^{m} Wcj;$$

$$Wnm = \sum_{c=1}^{m} Wcjn, \text{ or}$$

$$Wnm = \sum_{j=1}^{n} Wcjm;$$

$$Wc = Wcjn \div Wnm.$$

Thus, the criterion with the largest weight (Wc) is ranked first (RK = 1), the next largest second (RK = 2), and so on (1:283). Analysis of specific cases in Chapter IV indicated whether or not these higher ranked criteria

were actually used in the past.

Model Development

After examination of the criteria ratings, a dynamic decision model was developed. Designed as a management tool, the model incorporated and expanded on the essentiality decision process. Finally, areas of organizational responsibilities for reviewing/analyzing the abandonment alternatives were recommended in Chapter V. These recommendations were based on current regulations and on past duties performed by specific organizations during previous abandonment cases.

CHAPTER IV

DATA ANALYSIS AND MODEL DEVELOPMENT

Essentiality Criteria

Survey Test

The first step in the criteria validation was a test survey on a senior member of the Air Force Institute of Technology (AFIT) faculty. This individual suggested the following minor changes and areas requiring needed clarification: combine the two-part statements (survey items 9/10, 11/12, and 13/14) into one question each. Also the cost efficiency statements (items 7 and 8) had not yet been included and were subsequently added.

In summary, the test survey was well received and highly encouraged by the AFIT faculty member. The only additional criterion suggested was "the use of rail as a temporary storage facility for bulk products such as de-icers, etc." Table 4 indicates the ratings (Rcj = Ac), rating sum (RS = AS), and essentiality coefficients (ECc) generated from the responses to the survey test.

Personal Interviews

The second phase in the criteria validation process

TABLE 4
Survey Test Ratings (Rcj), AFIT

c	Rcj = Ac	ECc = Ac ÷ AS
1	9	.0789
2	8	.0702
3	8	.0702
4	4	.0351
5	4	.0351
6	8	.0702
7	////////////////	////////////////////
8	////////////////	////////////////////
9	4	.0351
10	4	.0351
11	3	.0263
12	6	.0526
13	6	.0526
14	6	.0526
15	3	.0263
16	6	.0526
17	3	.0263
18	6	.0526
19	8	.0702
20	8	.0702
21	7	.0614
22	3	.0263
AS	114	////////////////////

involved personal interviews with selected members of the staff of HQ AFLC at Wright-Patterson Air Force Base. The Directorates contacted included Logistics Plans (XR) and Distribution (LO); the specific branches/divisions were War-Logistics Planning (XRXX), War-Contingency Plans (XRXXX), and Vehicle Operations (LOZMV). Due to a particular member's extensive railroad experience and knowledge, the latter branch was included at the insistence of the logistics plans personnel.

Regarding the two-part statements, it was the opinion of the respondents that they should be retained because they offered two aspects of a not necessarily diametrically opposed situation. Suggested additional criteria included "the presence of defense priority guidance," e.g., strategically supporting the East coast at the expense of the West coast, and "a differentiation between wartime and peacetime missions." However, we considered the phrase "Air Force mission" as encompassing both scenarios.

The responses of the HQ AFLC interviewees can be seen in Table 5. The arithmetic average of their ratings (Ac) will also serve as the overall reply for AFLC in the final survey.

Telephone Survey

The survey concluded with telephone inquiries of the

TABLE 5
Personal Interview Ratings (Rcj), AFLC

c	XRXX	XRXXX	LOZMV	Ac	ECc
1	9	7	9	8.33	.0587
2	5	8.5	7	6.83	.0482
3	8	8	9	8.33	.0587
4	4	2	9	5	.0353
5	6	3	8	5.67	.0400
6	7	8	9	8	.0564
7	6.5	7	9	7.50	.0529
8	4	5	1	3.33	.0235
9	6.5	7	9	7.50	.0529
10	4	5	1	3.33	.0235
11	5.5	2	9	5.50	.0388
12	2	5	1	2.67	.0188
13	9	6	9	8	.0564
14	2	7	1	3.33	.0235
15	8	9	7	8	.0564
16	9	8.5	2	6.50	.0458
17	5	8.5	8	7.17	.0506
18	8	9	9	8.67	.0611
19	9	7.5	9	8.50	.0599
20	8	8	9	8.33	.0587
21	5	5.5	7	5.83	.0411
22	2	5.5	9	5.50	.0388
RS	132.5	142	151	////////	////////
AS	////////	////////	////////	141.82	////////

remaining CONUS MAJCOMs and HQ USAF. The majority of the logistics plans offices contacted responded without resistance. However, one MAJCOM commented that their logistics personnel had little transportation (particularly railroad) experience and could not adequately respond to the survey. In addition, a MAJCOM which "owns" no bases, also indicated a lack of rail service background. However, these two command representatives made an educated attempt to respond to the survey. While these two responses were hardly of the "expert" caliber expected and one was actually two standard deviations higher than the rest, they were retained for the purposes of this preliminary study.

The only logistics office that could not properly complete the questionnaire was the Space Command who directed the survey to their Transportation Directorate for more reliable responses. Although this situation failed to conform with our original intentions of confining the survey to logistics plans offices only, the study will retain the responses of the Space Command. Thus, all CONUS MAJCOMs were included in the entire process.

Despite such minor obstacles, the survey was completed and generally well received. The respondents also recommended consideration of the following additional criteria (as per item 22): (1) geographical location; (2) hazardous cargo transportation; and (3) the deployment of forces and their equipment to their designated POEs.

However, none of the recommendations occurred with the frequency needed to warrant inclusion as an additional survey criterion. Moreover, the criterion pertaining to the environmental aspects (item 11) can easily be construed to include hazardous cargo, and the criterion relating to the base as an APOE (item 1) was purposely broad to encompass all phases of deployment, whether outgoing or incoming. Finally, some respondents would have preferred a written survey, commenting that verbal responses can be less effective and supportive of the intended goal.

The ratings compiled for all CONUS MAJCOMs and HQ USAF can be seen in Table 6. The fact that none of the surveyed logistics experts suggested deleting any of the criteria and they were able to effectively rate these criteria, further validates their use in a decision methodology. However, at this point the researchers deleted certain criteria based on the results tabulated in Table 6. Of the original 22 essentiality criteria, five (items 8, 10, 12, 14, and 17) were deleted because the experts did not consider them "significant" in retaining rail service. All criteria with an average rating (Ac) less than 5 were removed from consideration. Further, the basic concept of each deleted criterion was already included in another survey criterion.

As indicated in Chapter III, the criteria statements with two parts, i.e., survey items 7/8, 9/10, 11/12, 13/14,

TABLE 6
MAJCOM Criteria Ratings (Rcj)

c	AFCC	AFLC	AFSC	ATC	ESC	MAC	SPACE	SAC	TAC	HQUSAF	Ac
1	5	8.33	9	8	9	7	6	9	8	4	7.333
2	8	6.33	9	8	7	6	6	6	7	8	7.183
3	9	8.33	7	9	4	8	9	9	5	8	7.633
4	2	5	7	5	4	3	5	2	3	4	4
5	7	5.67	8	5	6	4	8	3	6	6	5.867
6	9	8	9	8	9	5	5	8	7	9	7.7
7	7	7.50	9	7	7	4	5	5	7	7	6.550
8	3	3.33	1	3	3	7	5	4	1	2	3.233
9	7	7.50	9	6	6	7	4	1	6	6	5.950
10	3	3.33	1	3	3	3	5	1	1	4	2.733
11	6	5.50	9	6	7	7	7	7	3	8	6.550
12	4	2.67	1	4	3	4	3	1	1	4	2.767
13	6	8	9	7	7	6	4	7	6	8	6.8
14	4	3.33	1	3	2	3	4	2	1	3	2.633
15	7	8	7	4	7	8	3	9	8	6	6.7
16	7	6.50	8	8	7	7	5	9	7	5	6.950
17	7	7.17	5	3	3	4	5	5	4	6	4.917
18	7	8.67	8	4	4	7	4	6	8	6	6.267
19	8	8.50	9	7	8	8	4	8	8	7	7.550
20	9	8.33	9	9	7	7	5	8	6	8	7.633
21	7	5.83	7	6	9	9	9	9	7	8	7.683
22	3	5.50	8	6	7	8	5	5	6	5	5.850
RS	135	141.82	150	129	129	132	116	124	116	132	////////
AS	////////	////////	////////	////////	////////	////////	////////	////////	////////	////////	30.482

and 16/17, were intended to cover every possible aspect of that criterion. However, the average rating (Ac) received for these paired statements were in fact opposites. Consequently, the negative statement of each pair was judged "insignificant" by the experts and, therefore, excluded from further consideration in this study. The resultant "new" RS, Ac, and AS are displayed in Table 7 and the final 17 essentiality criteria are restated in Figure 2.

Essentiality Coefficient

From these calculations we computed the new essentiality coefficient (ECc). The result of this new ECc is a current Air Force standard for determining rail essentiality at a particular base. The ECc for the Air Force is detailed in Table 8.

Case Study Analysis

Overview

As indicated in Chapter III, six military rail abandonment cases were reviewed and analyzed. Four of these were Air Force facilities, two representing past abandonment action (Otis AFB and McGuire AFB) and two representing current abandonment activity (Loring AFB and Ellsworth AFB). These four installations comprise the Air Force's total rail abandonment history. In addition to the

TABLE 7
Revised Criteria Ratings (Rcj)

c	AFCC	AFLC	AFSC	ATC	ESC	MAC	SPACE	SAC	TAC	HQUSAF	Ac
1	5	8.33	9	8	9	7	6	9	8	4	7.333
2	8	6.83	9	8	7	5	6	6	7	8	7.183
3	9	8.33	7	9	4	8	9	9	5	8	7.633
4	2	5	7	5	4	3	5	2	3	4	4
5	7	5.67	8	5	6	4	8	3	6	6	5.867
6	9	8	9	8	9	5	5	8	7	9	7.7
7	7	7.50	9	7	7	4	5	5	7	7	6.55
8	7	7.50	9	6	6	7	4	1	6	6	5.95
9	6	5.50	9	6	7	7	7	7	3		6.55
10	6	8	9	7	7	6	4	7	6	8	6.8
11	7	8	7	4	7	8	3	9	8	6	6.7
12	7	6.50	8	8	7	7	5	9	7	5	6.95
13	7	8.67	8	4	4	7	4	6	8	6	6.267
14	8	8.50	9	7	8	8	4	8	8	7	7.55
15	9	8.33	9	9	7	7	5	8	6	8	7.633
16	7	5.83	7	6	9	9	9	9	7	8	7.683
17	3	5.50	8	6	7	8	5	5	6	5	5.85
RS	114	121.99	141	113	115	111	94	111	108	113	//////
AS	//////	//////	//////	//////	//////	//////	//////	//////	//////	//////	14.199

FIGURE 2

17 Essentiality Criteria

1. The base is an aerial port of embarkation (APOE).

2. The base is a storage location for pre-positioned assets, e.g., Seymour Johnson AFB vehicles.

3. The base heating plant has been converted to or is scheduled for coal conversion.

4. The connector line abandonment could reduce the size of the available civilian labor pool for employment at the base, due to possible loss of community businesses.

5. The connector line abandonment could result in a potential decrease in the number of suppliers to the base, e.g., meeting certain federal government socio-economic and political objectives such as contracting with small and minority businesses.

6. Other modes cannot be substituted for rail.

7. The use of rail is more cost efficient than other modes.

8. The use of rail is more fuel efficient than other modes.

9. The increased use of trucking would have detrimental environmental effects such as increased air and noise pollution, and road maintenance and construction costs.

10. The use of trucking would result in increased transportation rates.

11. The timeliness of service.

12. The non-availability of off-base outloading facilities within a reasonable distance.

13. The potential for increasing traffic to at least 5 million tons per mile annually, e.g., incoming coal shipments and training exercises utilizing rail.

FIGURE 2 (continued)

14. The inability to move the base's mission to another location.

15. The non-existence of a POL pipeline or barge for POL movement.

16. The presence of political influences, e.g., DOD, Congressional, local community officials/authorities.

17. The potential for the base to allow the carrier to increase rates to the carrier's breakeven point, given that this is considered by MTMC a last resort for policy reasons.

TABLE 8
Current Air Force Rail Service
Essentiality Coefficients (ECc)

c	Ac	ECc
1	7.333	0.0642125
2	7.183	0.0628990
3	7.633	0.0668395
4	4	0.0350266
5	5.867	0.0513752
6	7.7	0.0674262
7	6.55	0.0573560
8	5.95	0.0521020
9	6.55	0.0573560
10	6.8	0.0595452
11	6.7	0.0586695
12	6.95	0.0608587
13	6.267	0.0548779
14	7.55	0.0661127
15	7.633	0.0668395
16	7.683	0.0672773
17	5.85	0.0512264
AS	114.199	//////////////////////////

four USAF cases, two other military facilities (Fort Campbell and Camp Pendleton) were included in the analysis. The was a result of Fort Campbell's and Camp Pendleton's importance as MTMC abandonment "test cases."

Findings

The analysis findings from each of the six abandonment cases are presented in this section. In addition, Table 9 shows the essentiality scores (ES) computed for these facilities. Tables 10 through 15 display the criteria, essentiality factors (EFc), and essentiality score (ES) for the individual installations.

Otis AFB MA and McGuire AFB NJ. Compared with other bases, Otis AFB has a low ES of 0.5107 and McGuire has an ES of 0.6011. Of these two past USAF abandonment cases, Otis AFB had their line retained whereas McGuire AFB (with a higher ES) had their rail service discontinued.

However, this discrepancy can be explained in the Otis case. Due to significant state interest and pressure from other shippers along the line, the Commonwealth of Massachusetts intervened in the abandonment process, subsequently taking over the line. Consequently, rail service was preserved at Otis AFB. Had the State's action not ocurred, however, the Air Force would probably have allowed the line's abandonment. This conclusion is our assessment of comments received during interviews with HQ

TABLE 9
Composite Essentiality Scores

INSTALLATION	ES
FORT CAMPBELL	0.8044
CAMP PENDLETON	0.7032
McGUIRE AFB	0.6011
LORING AFB	0.5538
OTIS AFB	0.5107
ELLSWORTH AFB	0.4992
AVERAGE	0.6121

TABLE 10
Ft. Campbell Essentiality Score (ES)

c	CRITERIA APPLICATION	EFc
1	1*	0.0642125
2	0.5	0.0314495
3	1	0.0668395
4	0.5	0.0175133
5	0.5	0.0256876
6	1	0.0674262
7	1	0.0573560
8	0.5	0.0260510
9	1	0.0573560
10	1 @	0.0595452
11	1	0.0586695
12	1	0.0608587
13	1**@	0.0548779
14	0.5	0.0330564
15	0.5	0.0334198
16	1	0.0672773
17	0.5	0.0256132
ES	//////////////////	0.8044070

@Researcher conclusion.

*Staging area in lieu of APOE due to non-Air Force installation.
**Determination based on light density "rule of thumb" of 100 carloads per mile annually, e.g., Fort Campbell's 16-mile segment requires approximately 1600 carloads annually (16 miles x 100) (65:2).

TABLE 11
Camp Pendleton Essentiality Score (ES)

c	CRITERIA APPLICATION	EFc
1	1*	0.0642125
2	0.5	0.0314495
3	0.5	0.0334198
4	0	0
5	0	0
6	1	0.0674262
7	1	0.0573560
8	0.5	0.0260510
9	1	0.0573560
10	1 @	0.0595452
11	1	0.0586695
12	1	0.0608587
13	0.5	.0274390
14	0.5	0.0330564
15	0.5	0.0334198
16	1	0.0672773
17	0.5	0.0256132
ES	//////////////////	0.7031501

@Researcher conclusion.

*Staging area in lieu of APOE due to non-Air Force installation.

TABLE 12
Loring AFB Essentiality Score (ES)

c	CRITERIA APPLICATION	EFc
1	0 @	0
2	0.5	0.0314495
3	1	0.0668395
4	0.5	0.0175133
5	0.5	0.0256876
6	0.5	0.0337131
7	1	0.0573560
8	0.5	0.0260510
9	0.5	0.0286780
10	1	0.0595452
11	0.5	0.0293348
12	0.5	0.0304294
13	1* @	0.0548779
14	0.5	0.0330564
15	0	0
16	0.5	0.0336387
17	0.5	0.0256132
ES	////////////////////	0.5537836

@Researcher conclusion.

*Determination based on light density "rule of thumb" of 100 carloads per mile annually, e.g., Loring AFB's 30-mile segment requires approximately 3000 carloads annually (30 miles x 100) (66:2).

TABLE 13
Ellsworth AFB Essentiality Score (ES)

c	CRITERIA APPLICATION	EFc
1	0 @	0
2	0.5	0.0314495
3	0.5	0.0334198
4	0.5	0.0175133
5	0.5	0.0256876
6	1 @	0.0674262
7	1 @	0.0573560
8	0.5	0.0260510
9	0.5	0.0286780
10	1 @	0.0595452
11	0.5	0.0293348
12	0.5	0.0304294
13	0 @	0
14	0.5	0.0330564
15	0	0
16	0.5	0.0336387
17	0.5	0.0256132
ES	////////////////////	0.4991991

@Researcher conclusion.

TABLE 14
McGuire AFB Essentiality Score (ES)

c	CRITERIA APPLICATION	EFc
1	1	0.0642125
2	0 @	0
3	1	0.0668395
4	0 @	0
5	0 @	0
6	0.5	0.0337131
7	1 @	0.0573560
8	0.5	0.0260510
9	1 @	0.0573560
10	1 @	0.0595452
11	1 @	0.0586695
12	0.5	0.0304294
13	1* @	0.0548779
14	0.5	0.0330564
15	0.5	0.0334198
16	0 @	0
17	0.5	0.0256132
ES	////////////////////	0.6011395

@Researcher conclusion.

*Determination based on light density "rule of thumb" of 100 carloads per mile annually, e.g., McGuire's five-mile segment requires approximately 500 carloads annually (5 miles x 100) (66:2).

TABLE 15
Otis AFB Essentiality Score (ES)

c	CRITERIA APPLICATION	EFc
1	0 @	0
2	0 @	0
3	1	0.0668395
4	0 @	0
5	0 @	0
6	0 @	0
7	1	0.0573560
8	0.5	0.0260510
9	1 @	0.0573560
10	1	0.0595452
11	0.5	0.0293348
12	1	0.0608587
13	0.5	0.0274390
14	0.5	0.0330564
15	0 @	0
16	1	0.0672773
17	0.5	0.0256132
ES	//////////////////	0.5107271

@Researcher conclusion.

USAF/LETT personnel.

McGuire AFB's rail abandonment is more difficult to explain. Although McGuire's ES is not as high as Fort Campbell or Camp Pendleton, it is the highest of the four USAF facilities and ranks third overall. Unfortunately, however, McGuire AFB's case did not receive state intervention or extensive HQ USAF support. As a result, McGuire lost its rail service in March 1982.

Fort Campbell KY and Camp Pendleton CA. Both installations received high essentiality scores of 0.8044 and 0.7032, respectively. This is expected due to their importance as MTMC test cases and the high importance placed on rail by the Army and the Marines. Both facilities were studied extensively by MTMC and answers for most of the criteria were available (see Tables 10 and 11). As a result of this strong DOD interest and concern, rail service has been retained at both Camp Pendleton and Fort Campbell.

Loring AFB ME and Ellsworth AFB SD. As revealed on Table 9, Loring AFB and Ellsworth AFB both have relatively low essentiality scores. Loring is in a slightly better position with an ES of 0.5538. This is due to (1) more applicable criteria, and (2) more HQ USAF interest in the case. Conversely, Ellsworth AFB with an ES of 0.4992 has very weak justification for continued rail

service and consequently, less interest by HQ USAF. Since both of these bases are currently involved in the abandonment process, more studies and information may still be forthcoming. Also, some of the Ellsworth AFB information is classified and thus not available for this review. The essentiality scores for these facilities could increase when this information becomes available/accessible. Based on present information, however, it appears that the Ellsworth AFB line will be abandoned while further efforts will be made to retain Loring AFB's service.

Essentiality Scores

From the analysis of the base essentiality scores and the circumstances surrounding each case, three separate ES ranges have emerged. First, an ES of less than 0.50 indicates that rail service is not essential at the base. Second, an ES greater than 0.70 reveals a high degree of rail service importance at the facility; therefore, every effort should be made to retain rail service at the installation. Third, an area of uncertainty or "grey area" exists between an ES of 0.50 and 0.70, i.e., it cannot be absolutely determined whether base rail service is essential. Consequently, our standard or comparative essentiality score (ES*) appears to lie within this range. Unfortunately, application of this methodology to so

few available abandonment cases prevents us from pin pointing the ESX exactly.

Additional analyses of these case studies revealed the extreme importance of political influences. For example, Otis AFB had state intervention, and Camp Pendleton and Fort Campbell experienced extensive local governmental and DOD interest. As a result, each of these military installations have avoided abandonment. In addition, because it is receiving support from the state, Loring AFB will likely retain its rail service.

This is not the case with either McGuire AFB or Ellsworth AFB. Neither of these facilities have received assistance from state or local governments, nor has either received any substantial support for line retention from the DOD. Thus, despite McGuire AFB's ES of 0.6011 and its designation as a wartime APOE, rail service to the base was discontinued. Ellsworth AFB's service will likely be abandoned, although their justification for rail is much weaker than McGuire's. This importance of political factors or influence was also acknowledged by its first place ranking by the logistics experts across the MAJCOMs (see Table 16).

Weighting and Ranking

For a better understanding of the level of importance

TABLE 16
Criterion Weight (Wc) and Rank (RK)

c	AFCC	AFLC	AFSC	ATC	ESC	MAC	SPACE	SAC	TAC	HQUSAF	Wcjm	Wc	RK
1	.04	.07	.06	.07	.08	.06	.06	.08	.07	.04	.63	.064	6
2	.07	.06	.06	.07	.06	.05	.06	.05	.06	.07	.61	.062	7
3	.08	.07	.05	.08	.03	.07	.10	.08	.05	.07	.68	.069	1
4	.02	.04	.05	.04	.03	.03	.05	.02	.03	.04	.35	.035	17
5	.06	.05	.06	.04	.05	.04	.09	.03	.06	.05	.53	.054	13
6	.08	.07	.06	.07	.08	.05	.05	.07	.06	.08	.67	.068	3
7	.06	.06	.06	.06	.06	.04	.05	.05	.06	.06	.56	.057	11
8	.06	.06	.06	.05	.05	.06	.04	.01	.06	.05	.50	.051	16
9	.05	.05	.06	.05	.06	.06	.07	.06	.03	.07	.56	.057	11
10	.05	.07	.06	.06	.06	.05	.04	.06	.06	.07	.58	.059	9
11	.06	.07	.05	.04	.06	.07	.03	.08	.07	.05	.58	.059	9
12	.06	.05	.06	.07	.06	.06	.05	.08	.06	.04	.59	.060	8
13	.06	.07	.06	.04	.03	.06	.04	.05	.07	.05	.53	.054	13
14	.07	.07	.06	.06	.07	.07	.04	.07	.07	.06	.64	.065	5
15	.08	.07	.06	.08	.06	.06	.05	.07	.06	.07	.66	.067	4
16	.06	.05	.05	.05	.08	.08	.10	.08	.06	.07	.68	.069	1
17	.03	.05	.06	.05	.06	.07	.05	.05	.06	.04	.52	.053	15
Wcjm	.99	1.03	.98	.98	.98	.98	.97	.99	.99	.98	//////	//////	//////
Unm	//////	//////	//////	//////	//////	//////	//////	//////	//////	//////	9.87	//////	//////

of each criterion, Echenrode's weighting scheme was applied and the criteria rank ordered (RK). These computations and rankings are found in Table 16. An examination of these past abandonment cases showed that none of the specific military services or bases analyzed or considered all 17 essentiality criteria. In fact, none even considered all ten of those criteria ranked most important. This information is capsulized in the following table:

TABLE 17

Ranked Criteria Consideration

	Criteria Considered	Top Ten Criteria
Camp Pendleton	9 (0.529)	5 (0.50)
Fort Campbell	8 (0.471)	6 (0.60)
Otis AFB	5 (0.294)	4 (0.40)
Loring AFB	4 (0.235)	3 (0.30)
McGuire AFB	2 (0.118)	2 (0.20)
Ellsworth AFB	1 (0.059)	1 (0.10)

Both Fort Campbell and Camp Pendleton did fairly well in examining the most important essentiality criteria (60 percent and 50 percent respectively), again due to the emphasis placed by MTMC on these first two cases. As revealed by this table, however, the Air Force has thus far failed to include many of the most important criteria in their abandonment analyses.

Model Design

Now that a method has been developed for scoring rail

essentiality, a base confronted with rail service cessation can compare its own ES to the ES* and proceed through the decision flow presented in Figure 3.

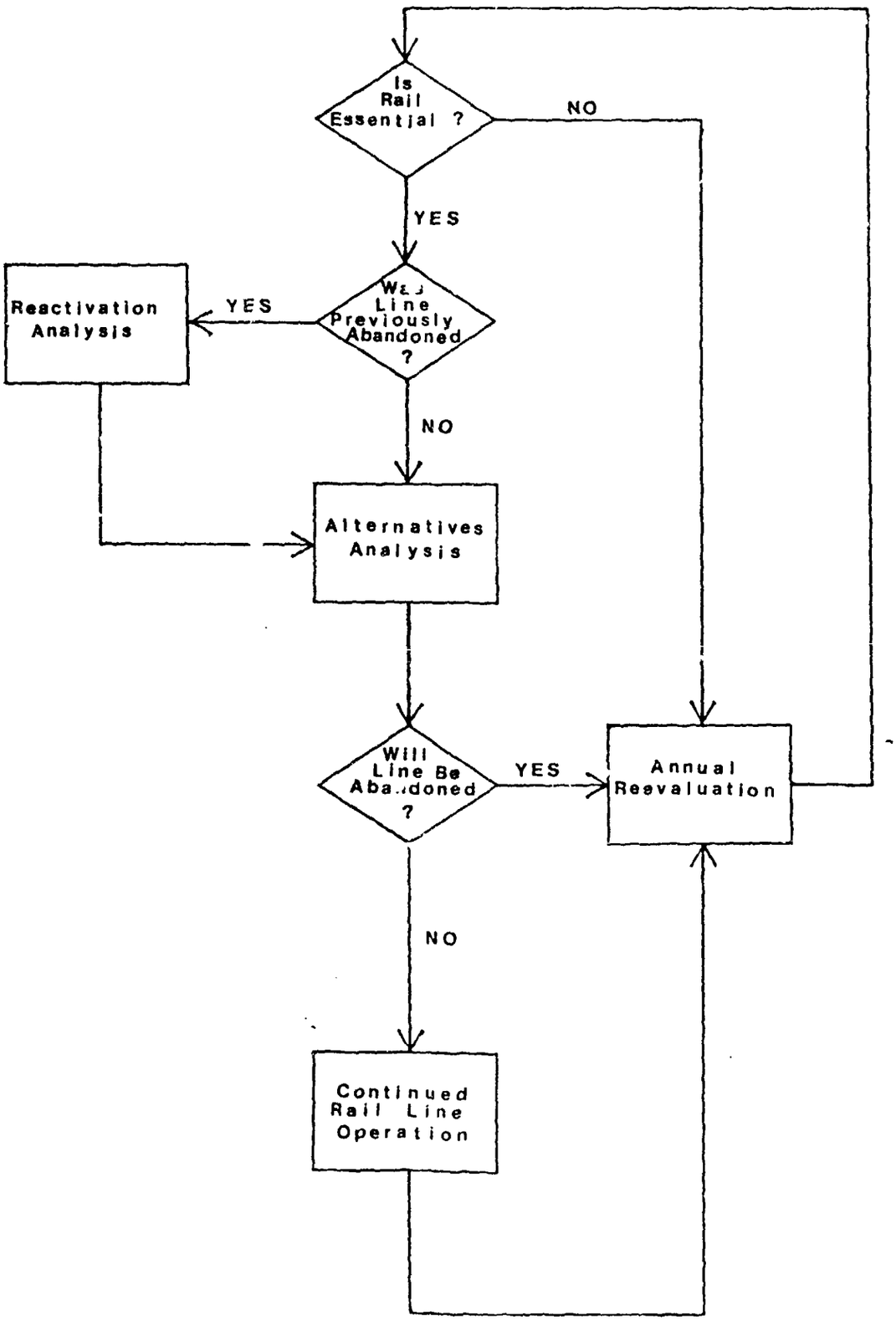
If the essentiality score (ES) falls within the "no" range, this implies that the base will not support the continued operation of the line segment and will in effect allow abandonment. However, the inclusion of an annual reevaluation of essentiality is paramount. This reevaluation will address such issues as changes in base mission requirements, introduction of new weapon systems, and evaluation of the performance of the replacement transportation mode.

According to Stock and LaLonde (107:57), such an evaluation should include the following:

1. Review of on-time performance of delivery service;
2. Review of on-time performance of pickup service;
3. Analysis of complaints;
4. Review of claims and loss experience;
5. Shipment tracing;
6. Distribution cost studies or audits.

As an example, because of a "captive market" situation, a problem that could surface might be an excessive increase in transportation rates charged by the mode that replaced

FIGURE 3
Decision Flow Chart



rail.

These annual reevaluations should be addressed prior to the submission of the base budget requirements. This is to ensure that base rail requirements are adequately funded.

If rail service has been deemed essential (or require reintroduction) the next step is to determine whether the rail line was previously abandoned. A "yes" response would indicate that at least the segment serving the installation, if not the entire trackage extending to the mainline, had been unused for a period of no less than one year. Obviously, such inactivity would produce various degrees of deterioration of the roadbed and track and would weigh heavily in any reactivation analysis.

In their assessment of the feasibility of reactivating segments of abandoned trackage in Colorado, Kansas, and Nebraska, Oman and Walker (89:389) departed from the usual cost benefit approach, preferring instead the potential revenues and potential costs under various possible operational arrangements. They compiled detailed revenue projections by segment, type of movement, and commodity group. This freight data can be developed from the various states' Reports of Revenue and the carriers' Waybill Samples, both of which are provided by the Federal Railroad Administration (89:392). Operating costs may be

computed from the ICC Rail Form A regional cost formula, a complex computation procedure through which unit costs of a railroad or territorial group of railroads are calculated (89:395). Annual costs for acquisition and rehabilitation can be estimated based on recent regional property purchases and on actual physical inspections (89:396). If the base is the only entity requiring reactivation of the abandoned segment, their personnel must conduct this preliminary analysis.

If the abandoned trackage now showed potential for reactivation based on changes in installation traffic volume or mission requirements, it would be treated the same as a newly proposed rail line segment abandonment. In either case, the next step involves conducting the Abandonment Alternatives Analysis (AAA) reviewed in Chapters II and IV.

If none of the alternatives are selected, the rail line segment will be abandoned, but the base will also conduct an annual reevaluation. Also, even if the line is kept operational through one of the alternatives, the annual reevaluation should still be performed. For instance, a program or policy change could occur at some future date, thereby reducing or eliminating the essentiality of rail service at that base. Such continuous monitoring could help identify areas where rail funds could be reprogrammed and diverted from installations no longer

requiring rail service to those facilities having a requirement.

Summary

We have developed and presented a relatively simple but effective decision flow methodology for the determination of rail service essentiality and the analysis of abandonment alternatives. In addition to offering general thesis conclusions and recommendations, Chapter V will recommend assignment of organizational responsibilities for completing the AAA portion of the decision model.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Overview and Limitations

The objective behind this thesis was to develop a formalized methodology for defining and determining rail service essentiality for U.S. Air Force bases, particularly those confronted with possible carrier abandonment. To pursue that goal, evaluations of past military and civilian abandonment cases were conducted and logistics professionals across the CONUS MAJCOMs and at HQ USAF were surveyed. This survey resulted in a list of 17 validated criteria considered important in determining rail essentiality at Air Force installations. The survey results were further refined through the formulation of essentiality coefficients (ECc), essentiality factors (EFc), essentiality scores (ES), and the development of a dynamic decision model.

Although we successfully met our objective, there are inevitably inadequacies in a study of this nature and magnitude. Certainly, the major problem encountered was the nearly complete lack of research in the area. Consequently, this thesis has assumed the position of being more a "preliminary probe" rather than offering "all the

answers" to a complex issue. More questions than answers may have been generated by this study.

In addition to assuming the role of "ground breakers," we also lacked all the necessary information to make more accurate and meaningful decisions in the ES determinations for the six military facilities. Thus, the scores for these bases provide less than optimal decision-making information. As more information becomes available, however, the utility of the ES should improve.

Finally, the formulations and decision model were developed specifically for USAF use. As such, they cannot be assumed to apply equally well to the other military services. The basic structure and framework of the formulations and decision model may be transferable, but the specific circumstances and pecularities of each service would have to be incorporated. The hope, however, is that the other services will modify the Air Force methodology to suit their own needs.

Original Research Questions

The introductory chapter to this thesis identified research questions that needed to be answered. These questions are restated below, followed by responses to each.

Research Question 1: What are the alternatives to

rail line abandonment?

HQ MTMC has identified nine DOD alternatives or options to employ when confronted with a potential civil rail line abandonment, however, only eight of these alternatives are applicable to the Air Force. These alternatives were presented and discussed at length in Chapter II and Appendix E.

Research Question 2: What are the potential impacts of civil rail line abandonments on military installations (based on experiences of civilian communities and selected military bases)?

Through extensive reviews of six military and numerous civilian abandonment cases, it was determined that various impacts may result due to the loss of rail service. The specific impacts, however, depend on several factors such as community size and geographical location. Regarding military facilities, impacts also depend upon base mission. Many civilian and military parallels were drawn, with in-depth results presented in Chapter II.

Research Question 3: What decision criteria should Air Force managers use to define/determine the mission essentiality of base rail service?

Seventeen important decision criteria were established through a review of base and community abandonment impacts

and alternatives, and through the conducting of interviews with MAJCOM and HQ USAF logistics professionals holding senior decision-making responsibilities. The final alidated rail service essentiality decision criteria are displayed in Figure 2 of Chapter IV.

Research Question 4: How should these criteria be incorporated into the mission essentiality decision?

The decision criteria were incorporated into formulations of essentiality coefficients (ECc), essentiality factors (EFc), and essentiality scores (ES) for judging the importance and determining the essentiality of rail service at individual USAF bases. These criteria and formulations were further integrated into a decision flow model designed as a management tool for USAF decision-makers. This process was developed and discussed in Chapter IV of the thesis.

Research Question 5: What USAF base, MAJCOM, and HQ USAF organizations should be responsible for the various procedures in the abandonment alternatives analysis and mission essentiality decision?

The abandonment alternatives analysis (AAA) is a complex base-level evaluation involving such areas as cost commodity, and volume studies, base contingency requirements, and contracting and legal constraints. The purpose is to provide information needed by USAF decision-

makers in arriving at decisions regarding which alternatives to pursue when faced with base rail service cessation. Since there are presently no assigned organizational responsibilities for performing this analysis, recommended organizational assignments are made in a later section of this chapter.

Conclusions

Based on the research from this thesis, several conclusions were reached. First and foremost, there have been no substantial DOD studies on the importance of rail transportation, especially its use as a wartime mobilization asset. Therefore, an integral and beneficial part of our defense transportation system may be overlooked. Second and somewhat related to the first, very little analysis is presently being conducted when an Air Force base is confronted with possible rail loss. That is, few of the 17 essentiality criteria are apparently being considered (see Table 17). Consequently, bases requiring rail service for mission accomplishment could lose their rail service due to insufficient impact analyses. A possible case in point is McGuire AFB, NJ, discussed earlier.

The third conclusion, related to the second, is that of the previous base analyses, most have not taken advantage of the available sources of data and information.

For example, the Freight Information System (FINS) is a DOD data bank offering vast data on transportation movements at all U.S. military facilities. The FINS includes such information as price, mode, volume, commodity, and dates of all movements originating or terminating at each military base. Obviously, these data are necessary if one is to adequately analyze the feasibility of base rail service. Unfortunately, it is used far too little in this regard -- again, particularly by the Air Force.

A fourth and final conclusion is the general lack of rail interest within the Department of Defense. This is especially true of the Air Force. Partly because of the "high technology" orientation of the Air Force and its members, rail transportation is perceived by most of its logistics officials as relatively antiquated. As one USAF official expressed during an interview, "We fly airplanes, not trains!" This particular attitude is further indicative of the problem surrounding the rail issue. Unless a transformation in attitudes takes place, additional abandonments and deterioration of base rail facilities will continue. In addition, improvements such as those offered in this thesis will not reach fruition. The potential impact from this neglect could very well be an inability to perform the mission.

Recommendations

Organizational Responsibilities

Since the late 1950s, many leading organizational theorists have advocated an open systems approach to the study of organizations (13; 60; 103; 111). While the thrust of this thesis is not a study of organizational relationships, per se, the dynamic environment in which the Department of Defense operates should still be considered. In response to the MTMC need and research question five, organizational responsibilities and assignments for accomplishing the rail essentiality and abandonment alternatives analyses are recommended below.

HQ USAF/LETT: As identified in Chapter IV, the comparative essentiality score (ESX) lies in the range of 0.50 to 0.70; however, it is our assessment that this is too wide for the decision process to be fully effective. Therefore, in line with current policy, HQ USAF/LETT should conduct further studies to narrow the acceptable range of the Air Force ESX, i.e., in what scoring area should rail be determined as essential or non-essential to a base. HQ USAF/LETT should also continue to provide appropriate policy guidance and serve as MTMC's focal point/liaison with the Air Force.

CONUS MAJCOMs: The appropriate MAJCOM should be responsible for conducting the base essentiality survey presented in Chapter III. This is to prevent the possibility of bias if conducted by the specific base. While answers to all of the criteria are unlikely to be found, the MAJCOMs should seek data to answer the most important criteria first. Also, because of their knowledge of MAJCOM and base funding and mission requirements, the MAJCOM should make the final decision regarding the appropriate alternatives(s) to pursue in the event of possible abandonment at one of its bases.

Base AAA Team: Currently, no USAF personnel have specific responsibilities for performing the crucial abandonment alternatives analysis (AAA). We recommend that a base team or committee be established with the following organizational members and responsibilities:

1. Traffic Management Office (TMO): Because the TMO is charged with managing overall traffic activities (including railroads) on the base, this office should play a key role on the team (118:Section 8; 122:2-3). The TMO would also be responsible for any transportation cost, volume, commodity, or modal studies.

2. Base Civil Engineer (BCE): The BCE has the cur-

rent responsibility of maintaining base trackage (117:1-5). The BCE would also conduct any line reactivation studies, or analyze coal requirements for those bases with coal-fired heating plants.

3. Logistics Plans Office (LGX): LGX has access to the appropriate war and mobilization plans and therefore, has the information to determine the impact of lost rail service on the base's mission. This office is also in a position to judge whether rail transport is a viable mode for training exercise use.

4. Staff Judge Advocate (JA): Many legal problems or considerations will inevitably arise during the course of the abandonment process, particularly in the form of contractual agreements, which may result during offers of financial assistance to the carrier. For this reason, the JA should also participate as a member of the AAA team.

5. Base Contracting Office (LGC): Because of the probable contractual arrangements mentioned in connection with the JA and due to their contract administration function, the base contracting office should also serve on the team.

6. Base Budget Office (ACB): Due to financial issues and funding requirements that will surface during the analysis of any abandonment alternative, it is recommended that ACB function as an integral part of the base team.

7. Base Management Analysis Office (ACM): As with ACB, ACM is also a member of the comptroller's staff. However, ACM is concerned with the preparation and consolidation of various management reports and analyses. Therefore, this office should be responsible for coordinating, organizing, and preparing the final report for presentation to the appropriate MAJCOM. Thus, the ACM serves in an important advisory capacity on the team.

8. Host Wing Vice Commander (CV) / Deputy Commander for Resource Management (RM): Finally, either the host wing CV or RM should function as the team or committee chairperson. As an alternative, the CV could serve as chairperson while the RM functioned in an advisory role to the CV. Either the CV or RM should provide the visability essential to the project. The chairperson should also ensure that the final report, along with recommendations, are coordinated through other appropriate base offices, e.g., wing and base commanders.

General Recommendations

In addition to the specific organizational responsibilities, several general recommendations have resulted from this study. First, more rail mobilized exercise deployments should utilize U.S. East Coast ports, particularly through McGuire AFB, New Jersey. In the past,

most military deployments have used Gulf Coast ports, limiting training to that area. Also, deploying through McGuire AFB will better determine whether the USAF decision to allow rail line abandonment to that base was wise.

A second related recommendation is to encourage more actual use of rail equipment and facilities in training exercises. This will serve as a test for determining such areas of base capability as sufficiently trained personnel, and operational status of loading/unloading equipment and facilities.

Third, consideration should be given to establishment of a DOD-wide rail service to operate and manage the rail facilities at each U.S. military facility. If this action is unwarranted, at a minimum a separate Air Force Specialty Code (AFSC) or "shred-out" within the transportation AFSC should be reestablished for personnel working in railroad related activities. This action would also ensure that proper training is received in the operation and maintenance of rail equipment.

Finally, in those instances where the military facility is the only shipper along the proposed rail abandonment, the establishment of a separate DOD agency for operating the line should be considered. Another alternative is contracting with one firm for the operation of all lines in the U.S. that meet the above conditions.

Contracting with one firm would assure continuity across the DOD and also encourage more competion among prospective contractors.

Further Research

The following three areas require further research:

1. For the formulations and methodology developed in this thesis to be more meaningful, additional research is required to establish the USAF standard or comparative essentiality score (ESX). Access to more information on past abandonment cases is required for accomplishment of this task.

2. Statistical studies and analysis should be performed on the 17 criteria and their associated essentiality coefficients (ECc). Possible statistical areas to explore include such techniques as factor analysis and discriminant analysis. These statistical tests or analyses will improve the confidence of the formulations and, therefore, the overall methodology.

3. While our study focused on the impacts of civil rail line abandonments, possible general research could also include the study of base rail equipment deterioration and its impact on mission performance and accomplishment.

Summary

As revealed earlier, this thesis is the first research to focus on the importance of rail service in meeting our defense logistics requirements; hopefully, it will not be the last. Our national defense depends heavily on a strong, viable, and integrated transportation network, which includes rail. The senior policy makers and transportation planners within the Department of Defense should take lessons from state and local communities where impacts of lost rail service are taken much more seriously. We must not allow hasty, poorly staffed analyses, or a lack of understanding to drive our decisions regarding rail's role in the defense transportation system. Hopefully, this thesis has contributed towards encouraging steps in the right direction.

APPENDICES

APPENDIX A

RAILROAD INDUSTRY TRENDS

Railroad Industry Trends

Beginning in the late 1930s, the Wagner Act led to the proliferation of unions in manufacturing industries. This in turn caused a reduction in the proportion of the labor force engaged in producing goods, and a corresponding increase in the proportion engaged in producing services. The rising educational level of the U.S. population has also led to a shift in the comparative advantage of the United States in the provision of such services as higher education, insurance, banking and other financial functions, and engineering, medical, and legal services. The exhaustion of various raw materials, especially the depletion of U.S. iron ore reserves during World War II, continued to reduce our comparative advantage for certain forms of heavy manufacturing--notably steel production (59:4). Railroad rate structures and technology gave a strong impetus to the development of a mode with a comparative advantage for moving goods high in value relative to weight, as well as perishable or fragile. The variety of manufacturers with these characteristics and the variety of points to which they are shipped have grown so greatly that specific point-to-point transportation of the type offered by trucking is particularly suited to both

the destinations and the character of the output (39:4).

Anthracite coal, once the dominant fuel for home heating in the Northeast, has been almost entirely superceded by natural gas (which does not move by rail at all), by oil (which rarely moves by rail), or by electricity, which may be generated in several fashions (of which the most recent do not require extensive rail transportation). The inputs of nuclear power stations are small in volume, heavy in weight, and pose considerable safety risks. As a result, these inputs are likely to move by truck, or if they move by rail, they do so in limited volume. Alternatively, electricity may be generated by coal at the mine mouth and transmitted long distances by high voltage alternating or direct current, again avoiding transportation (39:5).

Further, developments in the steel industry have been equally adverse for the railroads. The railroads lost consumer-goods traffic more rapidly than they lost capital-goods traffic. This had the inevitable consequence of making the entire industry increasingly vulnerable to business fluctuations as it declined, and specifically of making the eastern railroads increasingly dependent on the steel industry. Steel is apparently a declining U.S. industry whereas Germany and Japan now appear to have a comparative advantage in steel. This is analogous to the advantage America had in earlier years (39:6).

The eastern railroads had large shares of their assets in the form of urban terminal facilities which was not the case for railroads elsewhere in the country. These facilities were designed largely for termination of passenger or less-than-carload freight, activities for which the railroads have also lost their comparative advantage. In addition, the facilities are usually heavily taxed. The eastern railroads hauled the majority of American commuters, an activity which is generally unprofitable. Indeed, in most major cities commuter service is operated under state or municipal subsidy; frequently, however, such subsidies are not entirely compensatory, but rather simply compensate for out-of-pocket losses (39:6).

The relative weakness of the eastern lines gave rise to the view in the railroad industry (and to some extent elsewhere) that the weakness was exclusively an Eastern or Northeastern problem; however, this view was not correct. The strongest of the Western and Southern railroads earned rates of return which are only about half those in manufacturing industries (39:6).

The railroad industry is a mixed public and private cartel whose origins and present implementation are major sources of the current problem. In the late nineteenth century, for instance, the railroads engaged in collusive pricing coupled with pooling, usually of traffic, but

sometimes of earnings. In the short run, this practice resulted in a level of rail rates so high that in the 1870s there was considerable public outcry. A further consequence of cartelization was that the industry attracted excessive capital. Consequently, entry into U.S. railroading was relatively free. Accordingly, American railroads quickly found themselves duplicated by rival routes between the same terminals. As capital flowed into the railroads, rates fell until, by the mid-1880s, they were on average the lowest in the world. As a result, the industry became chronically unstable. This instability prompted enactment of the Interstate Commerce Act of 1877 which established the ICC and equipped it with powers intended to allow the rail cartels to stabilize themselves more effectively (39:7).

The ICC, however, was never vested with powers to issue quotas to the members of the cartel and was, therefore, forced to use its ratemaking authority to distribute traffic among the cartel members. The railroads collusively enforced their tariffs, which embodied a discrimination based mainly on a calculation of the value of the commodity relative to its weight. This discrimination, however, served as an incentive for the development of the truck with its comparative advantage for moving goods high in value relative to weight. Along with improvements in towboat and barge transportation on the

inland rivers, the truck further promoted the railroad industry's decline beginning about 1916 (39:8).

The Transportation Act of 1920 converted the ICC from a body that stabilized private cartels to an outright public cartelizing body with powers over minimum rates, control of entry and exit, control over capital formation, several devices which proved ineffective for equalizing the rates of return among carriers, and a target rate of return for the railroads. An effort to generate the target rate of 5.75 percent in a declining industry resulted in a level of rail rates so high that the incentive for shippers to turn to trucks increased. The proliferation of intercity trucking after 1926 created political pressures which eventually led to the inclusion of trucks in the cartel. The Motor Carrier Act of 1935 continued to extend the ICC's powers over interstate common carrier and contract carrier trucking with the cartel definition also including water carriers in the Transportation Act of 1940. The result of this was a non-pooling cartel consisting of 100 percent of railroading, approximately one-third of trucking, and less than 10 percent of water transport. Even apart from the incomplete nature of the cartel, the statutory authority for controlling it was thoroughly unsatisfactory because the ICC's procedures were established on a case-by-case basis, thereby developing a body of jurisprudence as it went along. Consequently, the statutory authority lacked

the specificity required for effective cartelization (39:9).

A well organized cartel, instead of using legalistic procedures of this character, would have a cartelizing body engaged in statistical calculations for the purpose of issuing quotas to equalize a marginal cost of each member of the cartel. The ICC, however, allocates freight by using its authority over rates to divide the traffic among carriers. As an example, the Commission established motor carrier rates sufficiently higher than railroad rates so that some shippers chose the higher quality of service by truck at the higher rates while some chose the lower quality of service by railroad at the lower rates. This policy prevented the carriers from achieving their comparative advantage on the basis of such relative costs for shipments as damage proneness, perishability, and urgency. As a result, the Commission ensured that trucks, railroads, and barges were kept in rivalry. This is the antithesis of pursuing policies which allow each mode to be used in accordance with its own comparative advantage. Indicative of the problem is that the cost of freight misallocation between railroads and truck lines has been estimated to be as high as $2.8 billion per year (39:10).

The cartelization of railroads in the nineteenth century was carried out on a regional basis, with the minor exception of certain cartels set up for specific

commodities. Resulting in a balkanized system of railroading, the industry was organized in such a way that the railroads would continually be in the positio as rivals, and as joint venture partners, simultaneously.

This organization produced a variety of adverse incentives for the railroads. For instance, when a railroad receives a freight car in interchange, its only incentive is to move tha car to its destination or to an interchange with the next railroad as inexpensively as possible. Therefore, the railroad receives no premium for getting the car to its destination quickly and, if the cargo is damaged, the originating railroad must bear the cost. The railroads endeavor to increase output per employee (and thus reduce costs) by running longer trains. This results in cars sitting idle for long periods while waiting to be consolidated into trains. Unfortunately, the nature of the technology is such that the longer the train, the higher is the probability both of damage to its cargo, and of derailment. Obviously, the more highly valued the commodities being carried, the greater the demand on the part of manufacturers for assurances about delivery, which in turn places additional pressures upon the rail carrier (39:11).

The organization of the rail industry produces relatively no utilization of its capital embodied in freight cars. The typical American freight car operates

only about 2-3/4 hours per day, traveling about fifty miles, and sits idle in a yard, on a siding, or elsewhere for the remaining 21-1/4 hours. This situation is further compounded by the nature of railroad car pricing. Railroads pay each other a "per diem" fee for the use of each other's cars, depending on where the car is at midnight. Not being a market determined price, the per diem fee does not fluctuate in response to demand. Consequently, in peak seasons, notably when agricultural products are moving in the fall, there is excess demand. As a result, the railroads have an incentive to hoard rolling stock against periods of excess demand and then engage in non-price rationing, favoring the habitual shippers in the allocation of cars (39:12).

Inevitably, the way in which this industry is organized creates an incentive to engage in counterproductive investment which is profitable only because of the inappropriate organization of the industry. Gravity classification yards (humps) are usually considered the preeminent example of such investment. These yards use highly capital intensive methods to make up the long trains for which the industry has an incentive to run and, because of resultant switching impacts at excessive speeds, also are a major source of damaged cargo (39:12).

The incentives derived from the way cars are priced led railroads to build cars that are extremely flimsy, but

still able to meet interchange requirements. Similarly, the incentives in the industry, especially over the last thirty years, have caused the railroads to build a large number of highly unstable cars. Piggyback flat cars, for example, when unloaded are prone to derailment on curves or entering sidings, and when loaded with two semi-trailers have high centers of gravity, wide amplitudes, and long natural frequencies when swaying from side to side. Also, tri-level automobile railcars, when loaded have high centers of gravity with wide amplitudes. Covered hoppers introduced since 1960, in an effort to secure ICC approval of grain rates at barge competitive levels, are also highly unstable (39:17).

These cars have proven to have natural frequencies of side-to-side movement that are augmented by the thirty-nine foot interval of the staggered rail joints characteristic of American track. This is especially true of speeds between fifteen-and thirty-miles per hour. Further, the augmentation of cars' natural frequencies by the thirty-nine foot rail joint interval is highly concentrated between ten-and thirty-miles per hour for various equipment types (39:17).

Mainline railroads ordinarily have speed limits for freight trains from forty-miles per hour to the seventy-five miles per hour usually considered the maximum safe speed for standard freight trucks. Deterioration of rail

joints from inadequate maintenance does not, at least initially, prevent operation at these speeds, but rather makes it unsafe to reach them by passing through the ten- to thirty-miles per hour range. Accordingly, the safe speed on a deteriorated railroad falls not from fifty-miles per hour to forty, but rather to ten-miles per hour, just below the range of maximum instability. Operation of a railroad at ten-miles per hour is extremely uneconomical. Consequently, the quality of service repels shippers, the productivity of the employees and of the motive power declines, and scheduled connections become impossible to maintain (39:18).

Even in less drastic situations, American freight trains are unstable. For example, a series of empty piggyback flats together is a dangerous source of instability at low speed. Trains are made up randomly, based on the order of car arrival and departure in a yard, or based on preblocking to destinations. As such, their track-train dynamic properties are not considered (39:19).

Present railroad technology has also led to more and more frequent derailments. For instance, the deterioration of rail joints augments the natural frequency of cars at speeds under thirty-miles per hour with the probability of derailment rising exponentially with the length of the train. For example, a freight train has a probability of derailment from equipment related causes of

0.001 at one-hundred cars, but 0.024 at over 250 cars. The number of cars derailing also increases more that proportionately to the increase in the length of the train (39:20).

Present railroad technology is also overly labor intensive. The coupling and braking system is judged automatic by late nineteenth century standards, but this no longer can be considered so. It requires large numbers of men in yards to lift the lever releasing the coupler, to ensure that one of the knuckles of the couplers on the cars being coupled will open, to make the connection between the rubber hoses that transmit the airline the length of the train, and to bleed out the air from the reservoirs on the cars so that they can be switched in yards. This technology also encourages strong unions by placing several groups in crucial positions which could tie up operations (39:20).

Basically, present railroading technology survives because it is well suited to an economic organization of an industry in which its firms are, simultaneously, both rivals and joint venture partners. Given the technology, it is inconceivable that the railroads can provide the quality of service to rival trucks. Under these circumstances, therefore, the nature of changes in demand for freight service simply ensures an indefinite continuation in the decline of the railroads (39:21).

Mergers

One of the worst aspects of the inappropriate incentives given to railroads is the incentive to merge. There are three possible motives for merging railroads. The first would involve end-to-end mergers with the goal of creating a small number of rival nationwide rail systems. Given the present organization of the industry, neither the Commission nor the individual railroads have incentives to bring about mergers of this type because, the resultant cost savings are not sufficient. However, the railroads and the Commission do have reason to bring about mergers for either of two other purposes. One is to merge parallel lines to consolidate terminal activity and make use of the better physical plant for intercity service. The merger movement that began in the mid-1950s was motivated by the hope of such savings (39:13).

The Penn-Central merger was the largest merger of parallel railroads. This was undertaken to secure economies of scale in terminal operations and preferable routing of freight, on the basis of the superiority of the physical plant of one predecessor railroad over the other. It was, also the most unsuccessful of such mergers. The labor economies expected were largely signed away in agreements with the unions. Moreover, the incompatability of their computers caused the predecessors to continue

operating separately in certain respects with confusion of outsiders at the separately operated facilities a conspicuous diseconomy. Consequently, it is generally thought that the predecessor railroads would have been better off had they never merged (39:14).

The third possible motive for railroad mergers is to make possible subsidization of weak railroads by the strong. Such regulation is essentially a form of taxation in which monopoly gains generated in one activity are used to subsidize some other activity. However, political pressures caused the ICC to try to retain mileage in the industry and, in particular, to prevent weak railroads from going out of business entirely. This behavior can succeed only when monopoly gain can be generated in an activity for use in subsidizing the other. When this ceased to be possible in the case of passenger trains, some other method of financing had to be found if they were to be preserved from extinction. The method chosen was the use of general tax revenues through the Amtrak system (39:14).

Similar considerations are involved in the abandonment of branchlines. The pooling of railroad traffic in the nineteenth century extended only to traffic received from connections; therefore, traffic originated by the railroad itself was not pooled. This gave the railroads an incentive to originate as much of their traffic as possible relative to that received from their connections. Thus,

those railroads which were most characterized by redundant mainlines parallelling one another between common terminal points also came to be characterized by high mileage branchlines. Iowa and its neighboring states in the upper Midwest have been the worst offenders in this respect. Michigan and eastern Pennsylvania, owing to the decline of lumbering and anthracite coal, also abound with redundant mileage (39:15).

Ironically, the branchlines with the least traffic tend to be the most profitable. A branchline that rarely has a train still incurs the fixed cost of taxes, but it also has small variable expenses; therefore, there is no real incentive to abandon it. The most unprofitable branchlines are those with frequent short trains providing a pick-up and delivery function for which trucks have the comparative advantage. It is the less utilized but profitable branchlines which are typically abandoned because they generate the least political pressure for retention. The more unprofitable branchlines survive, wasting labor and trapping cars (cars terminating on branchlines typically wait relatively long periods before being removed) (39:15).

APPENDIX B

RAILROAD LEGISLATION

Railroad Legislation

This appendix will provide additional information about the specific legislative acts mentioned in Chapter I. In addition, the details of the ICC abandonment process are discussed.

The Act to Regulate Commerce, 1887

Section One requires that all rates be "just and reasonable." The term "just" implies that rates must be fair to shippers in relation to what other shippers pay for moving similar commodities under similar conditions. "Reasonable" means that the carrier shall be allowed to earn a fair return on investment (ROI). Section Two prohibits personal discrimination, i.e., all shippers are to receive similar rates and services under similar conditions. The third section is a broad anti-discrimination clause, e.g., rebates and kickbacks became illegal. Section Four states that in most instances, a carrier cannot charge more for a short haul over the same route than for a long haul. The fifth section prohibits railroads from "pooling" or sharing traffic in markets where they choose not to compete. Finally, Section Six dictates that all rates and fares must be published (130:94-5).

The Transportation Act of 1920

Under Section 402, the ICC was empowered to ensure that:

> ...no carrier by railroad subject to this Act shall abandon all or any portion of a line of railroad, or the operation thereof, unless and until there shall first have obtained from the Commission a certificate that the present or future public convenience and necessity permit such abandonment [116:477-8].

However, Section 402 later exempts branchline abandonments from the review process by stating that ICC authority:

> ... shall extend to the construction or abandonment of spur, industrial, team, switching or side tracks, located or to be located wholly within one state... [116:478].

In addition to these provisions, a fine of not more than $5,000 or imprisonment for not more than three years, or both, is assessed for individuals failing to comply with the certificate requirements.

The Northeast Regional Rail Reorganization (3-R) Act of 1973

Apprehension about the capability of the Nation's railroad industry to support national defense can be traced

to the 3-R Act (71:6). This was a result of several DOD observations. For example, key clearance routes in the Notheast were frequently out of service, and delays in the movement of oversize/overweight cargo from the midwest to the east coast ports were experienced (71:6). In addition, the former "public interest" criteria which included national defense had been eroded through the increased use of economic considerations as a basis for approving rail abandonments (71:2). The comments of Professor Allen (1) of Iowa State University reveal the essence of the 3-R Act's new branchline policy which, in turn, is related to the DOD's abandonment concerns and observations.

In his paper, Allen indicates that the federal policy for the Northeast was based on two premises. First, the railroads should not be forced and cannot afford to continue cross-subsidization of uneconomic rail service. Second, those rail users and communities that are economically dependent upon the cross-subsidized rail service should not be unduly disadvantaged by the new policy change (3:5). As a result, those communities and users are eligible for government subsidies. The 3-R Act was subsequently extended nationwide with the Rail Revitalization and Regulatory Reform (4-R) Act of 1976.

The Rail Revitalization and Regulatory Reform (4-R) Act of 1976

Possibly the most important rail abandonment changes were those that increased the awareness of affected shippers and communities of an impending abandonment and assisted them in responding to the abandonment filing (3:6). These changes resulted from new statutory provisions of Section 802 which requires each rail carrier to submit to the ICC a diagram map of its entire rail system. In addition, more extensive information is required of the carrier in its Notice of Intent to abandon a line. Section 802(1a.) specifically states that:

> Each such diagram...shall include a detailed description of each line of railroad which is "potentially subject to abandonment,"...and shall also identify any line of railroad as to which such carrier plans to submit an application for a certificate of abandonment or discontinuance [114:128].

As a result of these new advance-notice requirements, shippers and communities served by the rail service will become aware of the possibility of loosing their service months before the actual abandonment application is filed. Thus, the shippers and communities can either (1) take action to save the service, e.g., increase line use, pay more for the service, arrange for a subsidy offer, etc., or (2) make plans to switch to alternative modes, if

available. In addition, the new ICC-published Notice of Intent helps interested parties by advising them on how to become participants in an abandonment proceeding and explains in detail how a person should file written comments or a petition to investigate. Abandonment changes were further addressed in Section 904, which requires the Secretary of Transportation to conduct a study of the potential effects of any abandonment of any line in the 31-state area outside the 17-state region addressed by the 3-R Act (114:148).

The second important change resulting from the 4-R Act regards rail service continuation subsidies which, in effect, permits intervention by a state to directly or indirectly subsidize a line in lieu of abandonment (112:12). Sections 803 and 805 of the Act are the two sections that provide for these continuation subsidies (3:9). Each section will be discussed below.

Section 803 of the Act developed a local rail continuation assistance program for the 31 states not covered under the 3-R Act. Several significant changes, however, were made to the program established in the Northeast. First, the financial assistance that the states receive can be used for a larger number of purposes. Whereas the 3-R Act only allowed rail continuation subsidies, the 4-R Act also permits the funds to be used for line acquisition, rehabilitation, or construction.

Second, the federal government's share of the cost increased to 100 percent in the first year with decreases to 70 percent in the fourth and fifth years. Third, the subsidy program lengthened from two years to five years. Finally, the method of allocating funds to the states by the Secretary of Transportation was modified (3:9). Section 805 was simply designed to bring the 17-state Northeast region addressed in the 3-R Act, in line with the new national program.

The Staggers Rail Act of 1980

Broadly speaking, the Staggers Act did not change the 4-R Act's provision requiring time frames for ICC consideration of an abandonment of line or discontinuance of service, and establishing the branchline subsidy program. However, Section 402 of the Staggers Act did change the specific time allowed to the ICC in considering and approving an abandonment. The time limits have been shortened, thus possibly favoring the rail carrier (115:1941).

Another important provision of the Act is Section 217 dealing with the application of various surcharges. While the Act attempts, as indicated, to provide for expedited abandonment of unprofitable lines, it also provides a way for improving the railroad's revenue and, possibly averting abandonment (128:11). Specifically, users of light density

lines may be charged additional amounts (called a surcharge) by the railroad when traffic volume is less than one million ton-miles per mile of line. Alternatively, in the case of a carrier whose earnings are judged inadequate by the ICC's standards as specified in the Act, the surcharge can be applied when traffic volume is less than three million gross ton-miles per mile of originating or terminating line (115:1917-18). The standard surcharge rate is 100 percent of "reasonably expected cost" on the light traffic segment and 110 percent of variable cost on the connecting route (115:1916). Reasonably expected costs are calculated as including a return on capital employed, determined at replacement cost (128:12). The Act also prohibits the ICC from interfering with the surcharges unless a shipper can demonstrate that the set percentages have been exceeded. How shippers could accomplish this, however, is unclear.

The surcharge provisions of the Act were designed to allow rates to be averaged and for federal subsidies to be diminished. Furthermore, proof of burden against rail systems operations considered adverse to the conduct of interstate commerce is no longer required. One transportation authority observed that while surcharges established thus far indicate the probability of severe impact upon shippers along light density lines, opportunity is afforded for prompt carrier financial relief (128:12).

He further proposes that a likely effect is the diversion of rail traffic, which will make trackage eligible for abandonment at an increased rate. As such, Congress has taken a major step toward expediting the shrinkage of "unneeded" track, a step long needed, he concludes (128:12). This, however, is precisely the fears of officials in the Defense Department.

The Staggers Act has received considerable mixed reaction from interested parties. However, the results of deregulation can generally be analyzed through its impact on price and service. Regarding price, Tom Richards, manager of rail consulting for A.T. Kearney, sees the following: (1) rates rising faster than inflation; (2) sharp increases for movements of single-car, intrastate, Northeast, and short (under 150 miles) traffic; (3) weakened regulatory protection for shippers; (4) disruption of historic rate relationships; and (5) the possibility of protection through new contract rates (21:51,54)

Mr. Richards also predicts several service impacts. These include: (1) short-run car shortages for small shippers; (2) car "auctioning" rather than allocation during peak demand periods; (3) pressure to take more risks through guaranteed minimum volumes and through more stabilized shipping patterns; (4) greater shipper involvement in transportation through contracts, cooperatives, car purchases, branchline purchases, or

private rail and/or truck fleet operations; and (5) the need to monitor carrier performance, especially where penalty/bonus contracts are in force (21:54). While it is still too early to completely assess the accuracy of these predictions, general indications suggest that they are reliable, but that shippers are fairing better than many had expected (30:32).

The Rail Abandonment Process

Subpart B of title 49 CFR requires each carrier to prepare and submit a rail system diagram map (as discussed under the 4-R Act) which shows the following five categories of lines: (1) lines to be abandoned within three years; (2) lines potentially subject to abandonment; (3) lines for which abandonment applications are pending before the ICC; (4) lines currently receiving subsidies; and (5) all other carrier lines (71:19). This information is then made public by two means. First, the ICC announces receipt of the diagram maps through the Federal Register; second, the rail carrier publishes portions of the map in newspapers of counties where categories (1) and (3) above are located.

Subpart C of 49 CFR 1121 specifies that the carriers must give "Notice of Intent" to file an abandonment application by (1) serving the Notice on the ICC, (2) serving the Notice to specified government agencies,

including MTMC, (3) posting the Notice at rail terminals along the line, and (4) publishing the Notice in pertinent newspapers (71:21). Further, this action is to be accomplished 30 days prior to filing the abandonment application. The Notice of Intent is designed to identify the affected line, specify the planned date for the application filing, state the reason for the proposed abandonment, and specify the procedures required for public protests and participation.

As just alluded to, the statutes also provide an opportunity for interested parties, such as local communities, shippers, or the DOD, to participate in the ICC abandonment proceedings. This is done through the filing of a protest with the ICC requesting that an investigation be conducted. However, the protest must be received within 30 days of the abandonment application's filing; otherwise, the law requires the ICC to approve the application. It should be noted that, as a result of recent legislation, the ICC is no longer required to investigate abandonment applications. Should they decide to do so, however, such action must be taken within 45 days of the application's filing, i.e., 15 days after the protests are due (71:21). It is during this stage of the process that interested parties may participate in the proceedings by presenting their cases for line retention.

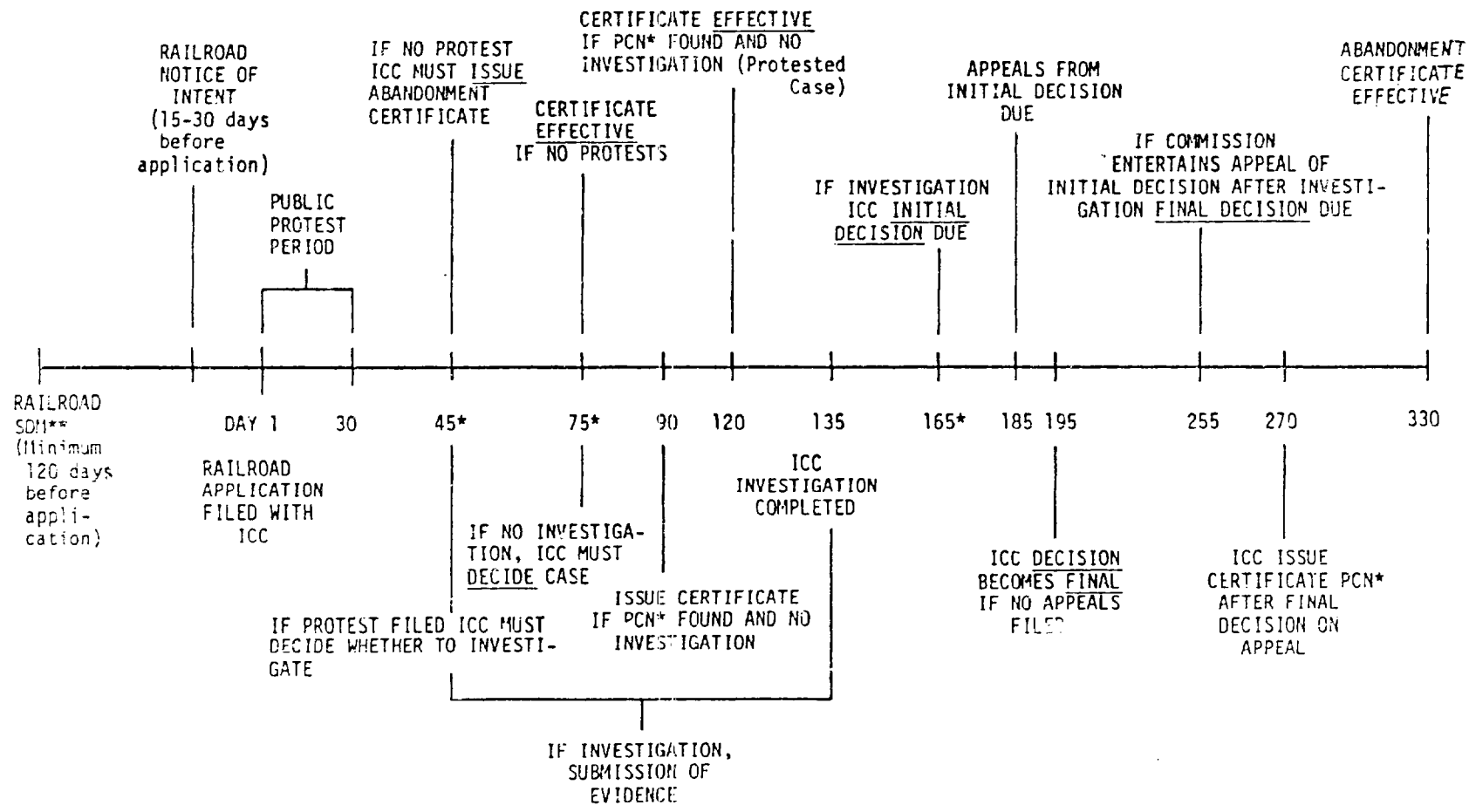
After the protest hearings are completed, the ICC must

make a decision within specified times to approve/disapprove the abandonment. The time requirements are dependent upon several factors; however, if the decision is to approve the abandonment, the ICC must issue a certificate to the carrier within 90 days, thus allowing the abandonment to occur within 120 days of the abandonment application's filing. If an investigation was conducted, the certificate must be issued within 15 days of the decision, which permits the rail abandonment to occur within 75 days of the final decision (71:22). Also, specified procedures have been established to allow an appeal of the ICC abandonment decision. Time constraints are also placed on this, generally 15 to 20 days.

The final step in the process relates to financial assistance proposals. Under procedures recently adopted by the ICC, responsible parties have 10 days after publication of an approved abandonment finding in the Federal Register to tender a reasonable offer for subsidizing continued operations over the line (96:56). If the offer is considered reasonable, the ICC will postpone the abandonment to allow time for negotiation of an agreement between the railroad and the subsidizer. If an agreement is reached, the ICC cancels the abandonment (in the event of a purchase) or postpones issuance of an abandonment certificate (in the event of a subsidy). If an agreement is not reached, however, within 30 days following the

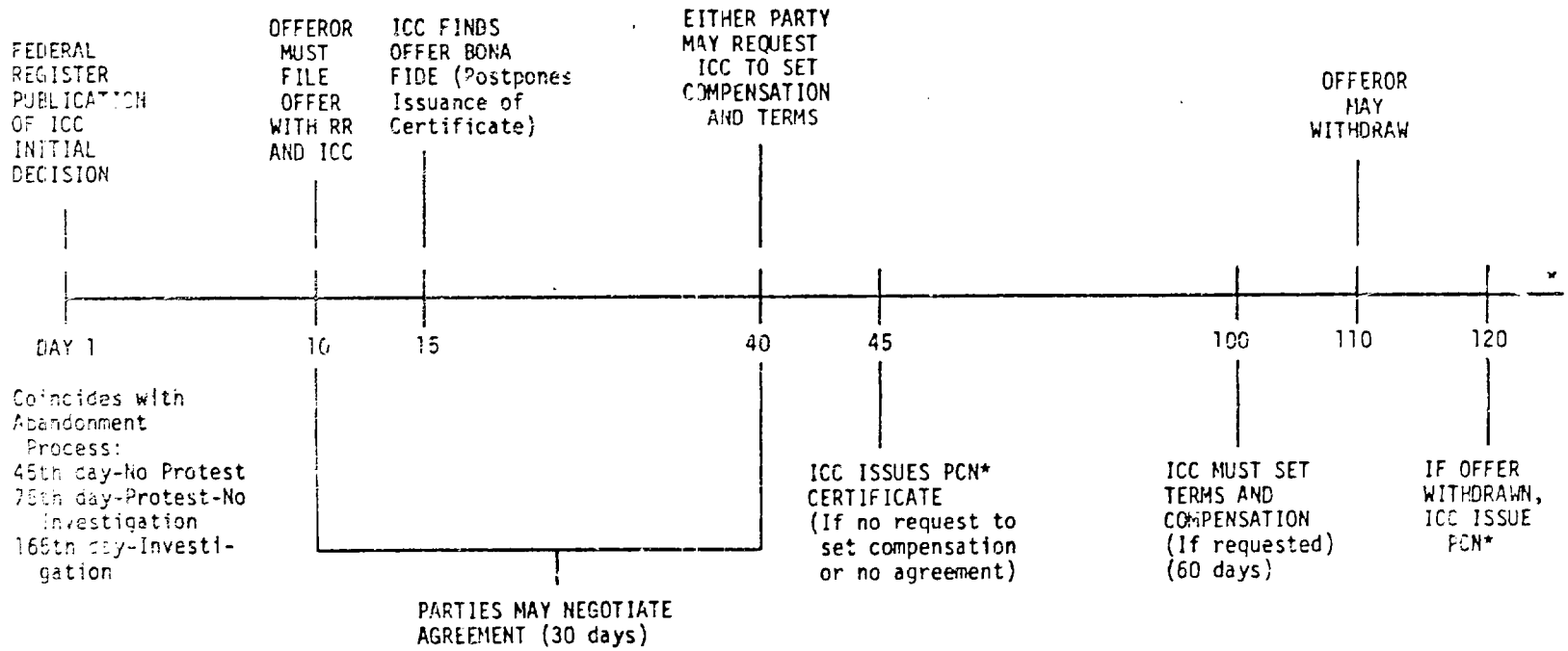
offer, the offeror may request the ICC to set the amount of subsidy or purchase price (71:22). These procedures are designed to run concurrently with the processing of any appeal; therefore, the filing of an appeal will not delay any of the above time requirements (96:50). In conclusion and to better illustrate the abandonment process, the required time-phased actions are included in Figures 4 and 5. In addition, the defense sector interface of MTMC is submitted as Figure 6.

FIGURE 4
ICC Abandonment Process (71:20)



* PCN - Public Convenience & Necessity
** SDM - System Diagram Map

FIGURE 5
ICC-Offers of Financial Assistance (71:23)



* After consummation of purchase agreement, ICC will dismiss abandonment case, and purchaser may not discontinue service for 2 years nor sell for 5 years; subsidized operations may be terminated by subsidizer with 60 days notice, after which ICC issues certificate of abandonment.

FIGURE 6
Time Phased Responsibilities (71:25)

Civil Sector Process →

Defense Sector Process ↓

	INSTALLATION RECEIVES SERVICE VIA LOW TRAFFIC DENSITY RAIL LINE	LOSS OF SHIPPER, REROUTING OF TRAFFIC, ACCIDENT, WASH OUT, FIRE, OR EMBARGO	SYSTEM DIAGRAM MAP (CAT. 1), ABANDONMENT NOTICE, OR APPLICATION	ABANDON-MENT PROCEEDING	FINAN-CIAL ASSIS-TANCE
PREVENTATIVE MEASURES:					
-Disseminate RND Info	*/	*/	*/		
-Increase Traffic	*/*	*/	*/		
-Accept Increased Rates	*/	*/	*/		
-Input to State Plans	*/*	*/*	*/*		
MTMC REVIEW & ANALYSIS:					
-Installation on List		*/*	*/*	*/*	
-Carriers Position		*/	*/	*/	
-State Programs		*/	*/	*/	
-Other Shippers		*/*	*/*	*/*	
-Potential Traffic		*/*	*/*	*/*	
-Defense Essentiality		*/*	*/*	*/*	
OPTIONS:					
-Carrier Retains			*/*	*/	
-State Retains			*/*	*/	
-Other Shippers Retain			*/*	*/	
-Increase Traffic			*/*	*/*	
-New Freight Rates			*/	*/	
-Out Load Off Post			/*	*/*	
-Participate in ICC Abandon Proceedings			*/*	*/*	
-Move Mission			/*	/*	/*
-Offer Financial Assistance					*/*

LEGEND:

MTMC */
Military Service /*

APPENDIX C

TRANSPORTATION PLANNING

Transportation Planning

Effective strategic mobility relies on the management and integration of all transportation assets (19:40-44). This effectiveness depends upon several factors, including:

1. Increased emphasis on intermodal systems;

2. Limited transportation assets;

3. Rapid response times.

Also, virtually every strategic mobility movement involves at least two of the transportation modes, and at times all of them (19:45).

In his presentation to the 46th Annual Meeting of the Committee on Transportation Systems Evaluation, Professor Marvin L. Manheim developed nine principles for analyzing transportation systems. These principles include consideration of "all modes" and their interfaces, and the provision for having equipment and operators available on a stand-by basis to provide organic deployment capability (35:86-91). A recent dramatization of these principles was conducted by the Space Shuttle program. The initial alternate landing site scenario developed by the aviation-oriented space agency required the Shuttle recovery equipment be transported by C-5As and C-141s supplied by the Air Force. The rail alternative devised by a resident

railfan/long-range planner, however, saved NASA over $1 million in each direction. Thus, "they put the space agency into the railroad age and saved a lot of money (65; 79; 100; 101)".

Ashford's analysis of strategic planning has identified six criteria areas to consider in the evaluation of long term transport commi ments (5:25). They include two key items: (1) the availability of the technology, or its potential for development; and (2) the constraints on solutions imposed by the limited availability of resources. These two ideas can be translated into industrial base and fuel supply. Ashford further points out that strategic planning must work toward the best interests, not only of current generations, but also of posterity. Short-term planning merely optimizes the conditions of one generation while leading to disaster for a later generation (5:26).

Industrial Base

The railroads are not just a mode for massive movements of war materials; they also serve defense as a co-industrial base. Railroads use up to forty percent of the forgings and castings in the country. For example, the same machinery and skills that produce rail car wheels are used to produce rifle barrels and tank treads (77:10). However, it appears that railroad operating equipment and trained manpower may not be sufficient to meet the demands

of mobilization. In addition, our national industrial base for producing railway equipment has steadily eroded (54:3). Due to excess wartime needs, the U.S. railroad equipment construction and repair industry must be maintained at high capacity levels. U.S. sources of railway parts and components must be revitalized and maintained as part of the nation's industrial base (54:64-65)

The ink for U.S. capability to mobilize for war is the American industry. In the two major wars of this century, the U.S. received and acted upon strategic warning. The deficiencies at the beginning of both world wars were in spite of several years of industrial mobilization that preceded our entry into these conflicts (78:54). To prevent a recurrence of this situation, the National Security Act of 1947 set up the National Security Resources Board (NSRB) to plan for the resources required to meet defense and security emergencies. Due to the Korean War mobilization, the Defense Production Act of 1950 subsequently replaced the NSRB with the Office of Defense Mobilization (ODM). Through the years the agency has continued name changes until finally becaming the Federal Emergency Management Agency (FEMA) in 1979 (9:68).

FEMA plays four major roles during mobilization. First, it coordinates all civil agency response to mobilization to support defense needs. Second, the agency allocates resources for defense production and expansion.

This includes priority and allocation authority for such projects as purchasing of large numbers of machine tools. Third, FEMA adjudicates resource conflicts between defense needs and essential civilian requirements. Finally, the agency provides overall direction and control for Defense Production Act Programs (9:61) such as the:

1. Expansion of Industrial Capacity and Resource Supply, currently unfunded, intends to provide funds for industrial revitalization and for defense preparedness labor training programs.

2. Voluntary Agreement Authority provides anti-trust exemption to industries working with government to accomplish various defense production goals. During the Korean War, for example, there were 75 agreements for production pools, warehousing, petroleum distribution, newsprint production, etc., whereas today there are only five agreements in "standby" status.

3. Machine Tool Trigger Program cuts administrative lead time and provides additional machine tools to industries that are surging various weapons systems. This program expired in 1969 and efforts to revive it have failed (9:62).

In 1976, the Defense Science Board (DSB) issued a report indicating that a combination of low defense procurements and the export of much of our industry to

foreign nations had led to a dangerous weakening of our defense industrial base. That same year MOBEX 76, the Army's first mobilization exercise in decades, called attention to numerous deficiencies and resulted in a follow-on DOD-wide exercise in 1978 called NIFTY-NUGGET. In 1980, the DSB again reviewed industrial responsiveness and determined that industry's ability to respond to defense needs had deteriorated and costs had continued to increase. An expanded mobilization exercise, PROUD SPIRIT, included the civil sector in November 1980 and also reported deficiencies in mobilization planning (78:56). Further analyses of the CROWD SAVER and REX 82 BRAVO exercises held in 1982 have yet to reveal whether the policy of the U.S. to have an emergency mobilization preparedness capability that will ensure that the government at all levels, in partnership with private industry and the American people, can respond decisively and effectively to any major national defense emergency.

Energy

Our dependence on oil has reached a point where sudden reductions in our foreign supply would result in serious national impacts. We import 45 percent of our total crude oil requirements and 79 percent of this comes from OPEC nations. Although a cutback in foreign crude production

can eventually be overcome through our national determination to find new sources, any immediate disruption of the supply can greatly hinder distribution (41:71).

The railroad industry consumes about two percent of petroleum distillates in this country. While somewhat controversial in the eyes of other modes, almost all studies have indicated rail efficiency is significantly higher per ton-mile than other modes (36:36). In the over-100 mile freight market, for instance, both truck and rail unit costs (in constant dollars) are expected to increase by about the same percentage. However, average truck costs per ton-mile currently tend to exceed rail cost for many commodities. Thus, the same percentage growth may result in a widening gap between truck and rail unit costs. If this happens, rail freight may become increasingly competitive with trucking (81:231).

The greater energy efficiency of the rail mode suggests that a quick transfer of shipping from truck to rail could help stretch fuel supplies. In studies where shippers were directed to choose modes that minimize the energy required to deliver cargo, regardless of cost, energy requirement dropped by one-third (41:74). However, any proposed scheme for saving fuel in an emergency should be scrutinized for a corresponding degradation in service (41:73). Average transit time for the portion of cargo shifted from truck to train would rise from 0.8 days to 6.8

days (41:75).

There are several reasons, however, why those who make the choice of mode would not ordinarily have an immediate incentive to conserve fuel during a crisis. Their objectives would be to ship their freight quickly and cheaply, avoid merchandise spoilage, and prevent customer alienation. Consequently, the best motivation for a modal shift would be realizing dry fuel tanks aboard many of the nation's trucks (41:75).

The capacity of railroads to absorb their share of diverted freight would limit modal shifts. The general consensus regarding rail capacity is that it would be limited much more by the availability of cars and locomotives (in the short term) than by congestion, except in such bottleneck areas as high-volume seaports (41:75). These car shortages could develop because trucks would not be available at the receiving end. As a result, cars would be left idle in terminal areas (57:93). In an effort to free locomotives, many railroaders would undoubtedly clamor for relief from their requirements to serve branchlines. This would, of course, necessitate an increase in truck service to the cut-off areas, potentially defeating the purpose of expanding railroad capacity. The new truck service would not only use more fuel but, if fuel supplies were short, it could also become unavailable (41:75).

Short term possibilities for increasing fuel efficiency in the rail system involve the following operational improvements:

1. Speed limit imposition such as initiatives developed by the Soo Line, while increasing running time, achieves noticeable fuel reductions. The resistance to the motion of a typical 100-car train is about 12 percent less at 40 mph than at 47 mph. Moreover, the Union Pacific Railroad attained an 8 percent reduction in fuel use in its first year of speed restrictions and more in subsequent years (41:78).

2. Extensive idling of locomotives between 40 percent and two-thirds of total operating time consumed 2.4 to 4 percent of total railroad energy use (41:78); however, the practice must be carefully controlled because diesel locomotives are costly to restart and highly susceptible to damage in low temperatures (20:12).

3. Presently, fuel is not metered while pumped into a locomotive; consequently, an estimated 4 percent is lost through spillage (41:78). Installation of automatic fueling devices and recycling of spilled fuel are obvious areas for improvement.

4. The average loaded car is filled to only 80 percent of its weight capacity. If these cars were to carry an additional five percent more weight, total car-miles would

decrease by 5 percent and an estimated 3 percent fuel savings would result (41:78).

5. Circuitous routings by one railroad to avoid turning a car over to another railroad offering a shorter route wastes fuel. Unfortunately, it is impossible to estimate the extent of circuitous routing without a detailed flow analysis of the rail networks. This requires more data than the railroads currently provide.

6. Finally, elimination of moving empty boxcars would reduce energy use approximately 13 percent. Imbalances of flow, however, constrain the issue, i.e., more rail freight has moved east and north than west and south, and the empties must be returned (41:78).

Rail carriers should experience noticeable efficiency and operations improvement over the long term. This is because long term responses to the energy supply tend to have the following technological rather than operational orientations (57:94):

1. Ironically, many strategies are intermodal in nature and heavily emphasize trailer/container on flatcar operations. Although this emphasis has been on truck-rail intermodalism, there are situations where rail could be more cost competitive by interfacing with waterways for certain hauls (57:94).

2. Electrification was widely discussed long before energy conservation became a major subject of concern. However, only about 0.6 percent of the national system is presently electrified.

Railroad diesel fuel consumption could be reduced if the 20,000 miles of highest density routes which carry about one-half of all rail tonnage were electrified. Approximately 1.5 to 2.0 billion gallons of petroleum per year could be saved, provided all utilities supplying the electric power relied on non-petroleum energy (81:98). The largest problem surrounding electrification is its extremely high initial investment. Also, while cost/benefit studies would confine installation to only high density lines, the railroad would still have to maintain both diesel and electric locomotive fleets (20:12).

Railroads are essential in th transportation of energy. They make their greatest contribution in transporting coal, moving two-thirds of the total quantity mined in the U.S. While it is not disputed that railroads are the best mode for coal movement, their ability to keep pace with enormous increases in coal shipments should be addressed. Energy programs that began in 1977, for example, called for a two-thirds increase in annual coal production by 1985 (20:14). Also proposed was conversion to coal by utilities and other large industries. This shift is necessary because, while coal accounts for 90 percent of

U.S. energy reserves that can be economically recovered by existing technology, it only supplies 18 percent of our energy needs today (20:14).

The railroads have estimated that near doubling of annual coal production to 1.1 billion tons by 1985 would require coal car acquisitions averaging from 12,000 to 17,000 a year, depending on the extent of unit train operations. In support of these estimates, orders for open top hopper cars during the last four years have increased 7.5 percent, now totalling 68,552 cars. This is more than the rate necessary to handle twice as much coal but, coal producers have achieved only half the rate necessary to produce a doubling in ten years (20:14).

The only serious limitations on expanded coal train traffic result from negative effects experienced by the communities these coal trains will pass through (105:45). These include the impedance of highway traffic and emergency vehicles, fewer possibilities of economic growth, and environmental deterioration that results from increased noise, dust, and vibration. Therefore, the affected communities might take action to impede the flow of coal traffic and thus reduce the efficiency of coal movement (105:46).

Considerations of policy that would mitigate the detrimental effects of increased coal train traffic on

communities have produced a range of low-and high-cost alternatives. High-cost remedies such as the construction of rail and highway grade separations would provide the most efficient means of avoiding community traffic congestion and the impeding of coal movement. Unfortunately, there is presently no local, state, or federal concensus on how to finance the estimated $643 million to $2 billion that would be required to build such grade separations (105:46).

In time, national policy objectives of increased coal production and energy efficiency are more likely to be achieved if the total cost of producing, ransporting, and converting coal is passed to the ultimate consumer. Tax mechanisms most likely to achieve a balance of these policy objectives include a national coal utility tax that would meet the "user pays" principle, or a federal coal severance tax similar to the existing national severance taxes levied to fund black-lung and mine reclamation programs (105:47-49). They could be imposed on coal uniformly and would help influence coal's competitive position vis-a-vis oil and gas.

A report prepared for the Department of Transportation entitled "Rail Transportation Requirements for Coal Movement in 1985" predicted that increased coal traffic would help rather than hinder the movement of other commodities (20:14). Also, lead times on the opening of new

mines are far greater than lead times for ordering and obtaining rail equipment or upgrading rail facilities. Further proof that the railroads can handle greatly increased traffic lies in the large amount of unused railroad system capacity. This unused capacity has been a problem in recent years; however, the prospect of greatly increased coal production presents an opportunity to convert the problem into a valuable national resource (20:15).

Forecasting

The final report of the Task Force on Railroad Productivity, Improving Railroad Productivity, attempted to analyze the complex maze of issues facing the entire railroad industry. Planning and marketing activities were areas of innovation that the task force believed to be sources of significant gains in railroad productivity. Also noted was the geographic "Balkanization" that victimizes the railroad industry in the United States. For instance, there are approximately seventy Class I railroads which are simultaneously competitive but mutually dependent. Railroads which originate shipments for a particular commodity are dependent upon the planning (or lack of planning) of other connecting carriers. As such, shippers and consumers judge

the price and service associated with a complete move, not the individual segments which can be attributed to separate railroads (90:19).

The total environment facing any corporation contains those variables which are determined by explicit management decisions and those which are external to the company. The growth rate of GNP, the overall rate of inflation, the level of interest rates, the unemployment rate, industry sales, loan availability, and cost changes are all beyond the control of a specific company. However, the typical corporation has significant discretion in such areas as determining the price and quality of its product, advertising expenditures, choice of market, volume of external funds to be raised, and total plant capacity (90:19).

Normally, with an analysis of external variables, the planner can map out alternative scenarios for management consideration. In the railroad industry, however, there are significant and fundamental differences in the sequence of planning and decision-making. These differences arise from the interdependence existing among all railroads. A single unit of rail output (service), for instance, may require sequential inputs from several railroads (90:19).

Capacity is an ambiguous concept for the individual railroad because it is easier to define or measure capacity

on a nationwide basis. The capacity or capabilities of an individual railroad are dependent upon all other railroads in the system. Similarly, the individual railroad does not have total control over the quality of its service. Regardless of the promptness of the originating railroad, other connecting railroads may push the total delivery period beyond the allotted time. Also, the individual railroad does not have much latitude over the price of its service. Pricing changes desired by one railroad as a method of developing a complete marketing package may be rejected (and thus vetoed) by other connecting carriers (90:20).

This interdependence permeates the most crucial dimensions of the corporate planning process within the railroad industry. Unknown planning parameters for each individual railroad are the collective interpretation of future business conditions by all other railroads, and the impact of the resulting decisions on system capacity and quality (90:20). This structural interdependence imposes a need for a two-tiered planning system. The first level involves the individual railroads analyzing and deciding and the second tier provides a rational framework for synthesizing and integrating the analyses. This method would thus isolate the potentially conflicting plans of various railroads, thereby enhancing the chance of mutually beneficial decisions (90:20). While the second level of

planning does not imply a nationalized system, it does require an attitudinal change on the part of railroads toward the issue of cooperation.

A few of the less viable/profitable railroads have incorporated the econometric approach to forecasting. While this yields projections for various expenditure aggregates (consumption, investment, etc.) and, with the aid of more elaborate input-output matrices, projections of intermediate product categories, it is still inadequate for the rail forecaster in terms of both the breadth of commodities covered and the depth of individual commodity detail. The ultimate advance for rail users of econometric models would be point-to-point (region-to-region) models which move from aggregate projections of final, intermediate, and raw commodity ouput to the concomitant commodity flows which result from this economic activity (90:21).

While comodity-flow forecasting waits future development, rail forecasters must still come up with tonnage and revenue projections to facilitate the process of capital budgeting and long-range planning. Historically, railroads have relied on the bottom-up approach. Typified by most sales forecasts, regional projections are gathered from sales personnel and then pyramided into an aggregate forecast (90:21). This approach, however, should be complemented by econometric

projections.

The initial problem facing the rail planner is the determination of the level of commodity disaggregation. This determination could run the spectrum, e.g., from detailed individual commodity forecasts of tonnage to aggregate magnitudes for revenues and tonnage. Ultimately, there is a trade-off between increased detail and greater start up time (90:21).

Railroad industry analysts have traditionally concentrated on ratios such as revenue per ton-mile, average miles per haul, average ton-miles per ton, and average revenue per carload. It is quite dangerous to assume that the various ratios remain constant; more likely, they are dynamic. A better alternative approach would be the development of statistical relationships which could measure the presence or absence of stable linkages between revenue, tonnage, and ton-miles (90:22).

Assuming that the key forecast variable is commodity tonnage (a function of rate level, geographic characteristics, seasonal influences, rate elasticity of competitive modes, elasticity of demand for the transported product, class of traffic, growth of domestic and world economies, etc.), directly relating national production/tonnage to the individual railroad's tonnage would preclude many factors, including

1. The relationship between national economic growth and rail industry growth;

2. The relationship between individual railroad economic increase/decrease and the total rail industry economy.

Thus, a "clean" forecast would involve projections of national sales and share, regional sales and share, and the individual railroad's share of national and regional business (90:22). The second tier of planning would facilitate this process.

In many instances the rail forecaster may have a firm grip on rail demand but no meaningful measurement of system capacity, which is a function of technological change and innovation. Some factors impacting the capacity of the individual railroad would include (90:22):

1. Total diesel power;

2. Composition of diesel fleet by age, type of units, etc;

3. Quality of terminal facilities;

4. Physical condition of roadbed;

5. Composition of railroad car fleet by age of cars, type of cars, substitutability of cars, etc;

6. Capacity of other railroads;

7. Commodity mix to be carried.

The ultimate attainment of forecasts assumes that the equipment, service, and pricing decisions of all other

railroads do not nullify the basic planning assumptions of the individual railroad. Again, the second tier of planning is needed in the areas of capacity measurement and long range planning (90:22).

The rail forecaster must analyze the implications of a changing commodity mix and include measures of cyclical sensitivity. Rail transport will experience uneven growth in various commodity sectors. This will further compound the forecasting problem because tonnage, ton-miles, and revenue will follow divergent paths. To simply project aggregate tonnage and multiply by a previous level of revenue per ton (average haul) would fail to consider the fluctuation in bulky materials (which generate a low revenue per ton-mile) and finished products (which have a high revenue per ton-mile). It is unlikely that any major railroad will enjoy this static-mix situation. Consequently, first level planning needs a consistent national picture of changing commodity patterns (90:23).

The rate elasticity problem, because of the myriad of commodities involved, is as complicated for the rail forecaster as is the measurement of capacity. The revenue impact of rate increases lies at the heart of the planning process for railroads. Differing interpretations of commodity elasticities by various railroads will invariably lead to a divergence in revenue forecasts and long run capital commitments (90:23). Two-tier planning can

overcome these obstacles and thus benefit all railroads by providing an increased flow of information in an environment of interdependent decision making (90:24).

Summary

Theoretical transportation planning has addressed the concern for including railroads in total systems planning. Also, related subsystems such as the industrial base and energy are relevant topics in rail planning considerations. Finally, knowledge of current rail industry forecasting techniques can aid the logistics planner to better incorporate railroads into future defense scenarios.

APPENDIX E

DOD CONCERNS

Department of Defense Concerns

Railroads for National Defense (RND) Program

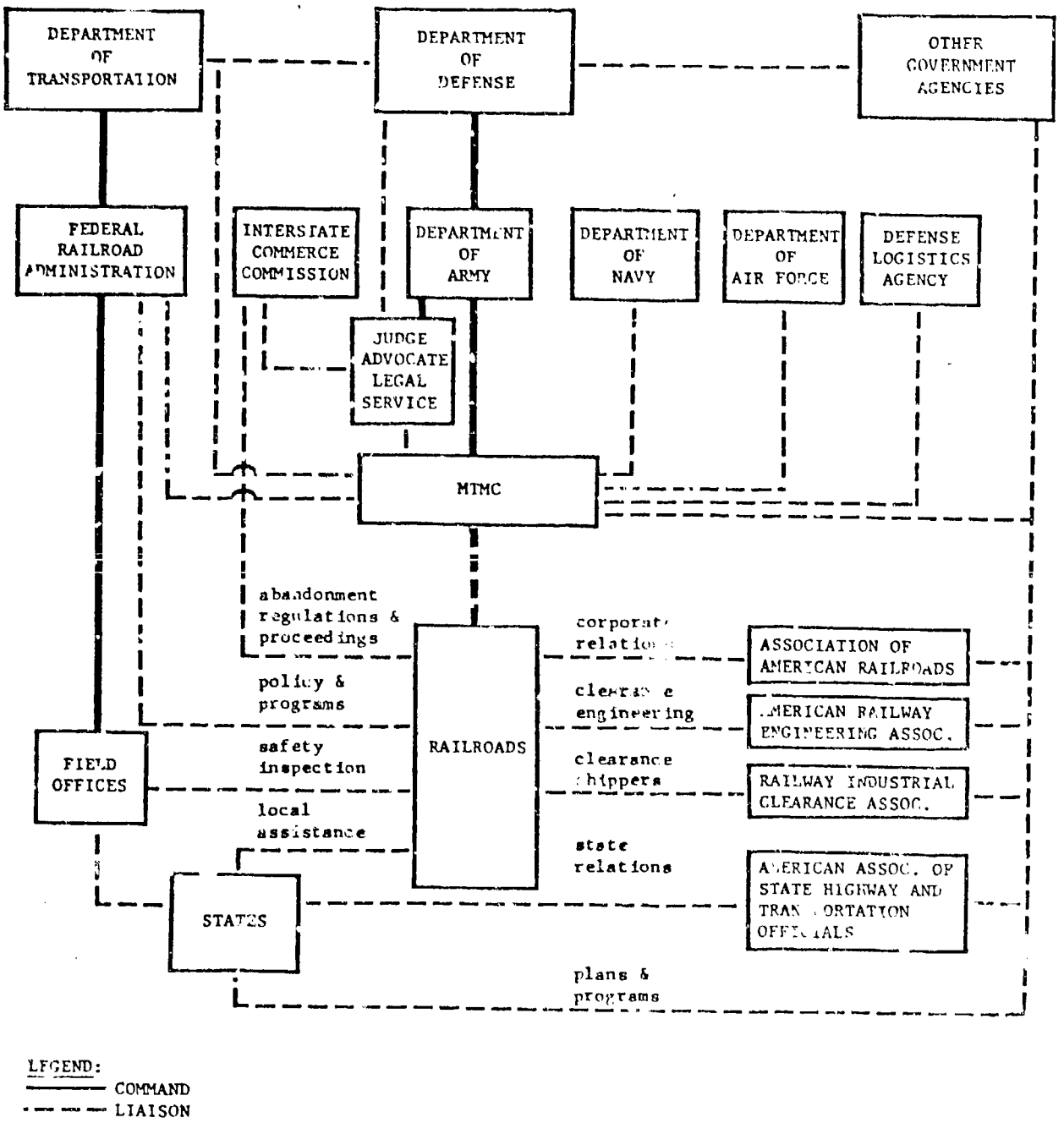
The initial DOD concern about the capability of the Nation's rail system to support the national defense was a result of the bankruptcies of most railroads in the Northeast in the early 1970s (71:6; 73:8). Additional factors giving rise to concern included: (1) excessive transit time to move outsized equipment such as combat tanks; (2) United States Railway Association (USRA) forecasts of three to seven years to upgrade deteriorated mainlines; (3) military services' reports of deterioration and unsafe track conditions; (4) various studies of possible line abandonment; and (5) imminent shutdown of major-system rail segments (69:1). As a result, Deputy Secretary of Defense William P. Clements forwarded a letter in June 1975 to Transportation Secretary William T. Coleman delegating to the Commander, MTMC, responsibility for the RND program. A special project group was then established within MTMC's Office of the Special Assistant for Transportation Engineering. The responsibilities of the new group and the purpose of the RND Program are to solicit civil government, railroad industry, and DOT consideration and support of defense requirements for rail lines (71:6; 73:8).

The coordination channels external to MTMC reflect an extremely comprehensive and continuous planning process involving numerous civil and defense agencies/officials. Those participants from the civil sector include various federal and state agencies, railroads, and trade associations such as the Association of American Railroads (AAR), the American Railway Engineering Association (AREA), the Railway Industrial Clearance Association (RICA), and the American Association of State Highway and Transportation Officials (71:6). To portray the extent and diversity of the coordination channels, Figure 7 is included as a reference.

Strategic Rail Corridor Network (STRACNET)

Among the initial products of the RND Program was MTMC's publication of a report (69) identifying "the requirement for an integrated and interconnected network of mainline having rail line clearance for oversize and overweight defense shipments [71:8]." Published in November 1976, the STRACNET report reflected requirements for the capability to transport defense materiel and equipment expeditiously throughout the country (71:8; 73:9; 69:x). As a result, four separate analyses were performed to provide information necessary in designing an appropriate network of geographical rail corridors. Three of the analysis areas were objective measures of the corridor

FIGURE 7
RND Coordination Channels (71:7)



network, while one area was concerned with the consideration of subjective criteria. The objective measures were (1) volume moved, (2) physical clearance required, and (3) desired traffic patterns for origin and destination pairs. The subjective evaluation included interconnectivity, service, and strategic requirements. Each of these analysis areas will be briefly reviewed.

Volume Analysis

While the DOD generates less than one-half of one percent of all peacetime rail carload traffic, it can still be considered a large user of rail transportation, moving approximately 100,000 carloads of peacetime traffic annually (69:3). Given this large volume, an analysis was conducted to determine the impact of rail line classifications mandated by the 4-R Act of 1976, and the relationship of DOD rail traffic to the existing rail structure.

To identify the spatial patterns in the movement of defense cargo, an investigation of rail carload geographical distributions by origin and destination was made. Using sampling methods and sensitivity analysis, MTMC found that seven states orginated more than 50 percent of all DOD traffic, while the top ten states accounted for nearly 60 percent. Seven states also accounted for more than 50 percent of the terminating traffic, with five of

the seven states also originating the most traffic (69:3). Table 18 shows both the originating and terminating carload traffic by state, percentage, and rank for the period 1 August 1974 to 31 July 1975. Figure 8 also shows the geographical distribution of the traffic. As a result of the analysis, a base rail corridor network was developed through which corridor routings were conducted (69:x). In addition, a volume categorization of defense carload traffic within corridors was established.

Clearance Analysis

The second area of DOD concern was clearances for outsize/overweight equipment (see also Figure 9). Due to the reorganization of rail lines in the Northeast, the retention of clearance routes became an important defense issue. Therefore, MTMC established clearance corridors by using RICA clearance routes of the Northeast and by analyzing clearance data on combat tanks.

According to MTMC, combat tanks were selected as a unique outsize/overweight indicator because they represent (1) a high priority sophisticated weapon, (2) an overweight equipment item, (3) an outsized item of equipment for rail due to their excessive width, and (4) because they have been shown to require excessive transit time movement (69:20). Examples of other outsized defense equipment also include tank retrievers, scissors launching bridges, ship

TABLE 18
Origin and Destination
Rail Carload Traffic (69:4-5)

State	Origin Carloads	Per Cent	Rank	Cum. Pct. by Rank	Destination Carloads	Per Cent	Rank	Cum. Pct. by Rank
Alabama	2,260	2.99	8	.5404	2,857	3.78	9	.6124
Arizona	295	0.39			546	0.72		
Arkansas	581	0.77			489	0.65		
California	4,515	5.96	3	.3358	6,485	8.58	3	.3672
Colorado	753	0.99			770	1.02		
Connecticut	34	0.04			59	0.08		
Delaware	75	0.10			6	0.01		
Florida	2,199	2.90	10	.5988	1,089	1.44		
Georgia	840	1.11			2,095	2.77		
Idaho	205	0.27			229	0.30		
Illinois	1,901	2.51			1,800	2.38		
Indiana	2,228	2.94	9	.5698	1,566	2.07		
Iowa	1,588	2.10			1,107	1.46		
Kansas	1,703	2.25			1,512	2.00		
Kentucky	1,328	1.75			1,396	1.85		
Louisiana	1,270	1.68			3,161	4.18	7	.5352
Maine	19	0.03			157	0.21		
Maryland	174	0.23			375	0.50		
Massachusetts	158	0.21			166	0.22		
Michigan	3,535	4.67	5	.4364	2,586	3.42	10	.6466
Minnesota	1,816	2.40			46	0.06		
Mississippi	446	0.59			404	0.53		
Missouri	867	0.15			653	0.86		
Montana	30	0.04			87	0.12		
Nebraska	207	0.27			55	0.07		
Nevada	453	0.60			328	0.43		
New Hampshire	15	0.02			19	0.03		
New Jersey	355	0.47			842	1.11		
New Mexico	259	0.39			225	0.30		
New York	691	0.91			507	0.67		
North Carolina	11,836	15.63	1	.1563	13,765	18.21	1	.1821
North Dakota	1,939	2.56			3,182	4.21	4	.4093
Ohio	1,800	2.38			2,105	2.78		
Oklahoma	506	0.67			1,557	2.06		
Oregon	312	0.41			175	0.23		
Pennsylvania	3,238	4.28	6	.4792	3,174	4.20	6	.4934
Rhode Island	124	0.16			21	0.03		
South Carolina	2,370	3.13	7	.5105	2,979	3.94	8	.5746
South Dakota	69	0.09			116	0.15		
Tennessee	4,082	5.39	4	.3897	3,181	4.21	5	.4514
Texas	9,076	11.99	2	.2762	7,505	9.93	2	.2814
Utah	1,957	2.59			1,284	1.70		
Vermont	8	0.01			6	0.01		
Virginia	1,597	2.11			2,167	2.87		
Washington	1,978	2.61			2,045	2.71		
West Virginia	1,561	2.06			30	0.04		
Wisconsin	1,978	2.61			482	0.64		
Wyoming	96	0.13			117	0.15		
Canada	381	0.51			87	0.12		
Total	75,708				75,708			

FIGURE 8
Geographical Distribution of DOD Traffic (69:6)

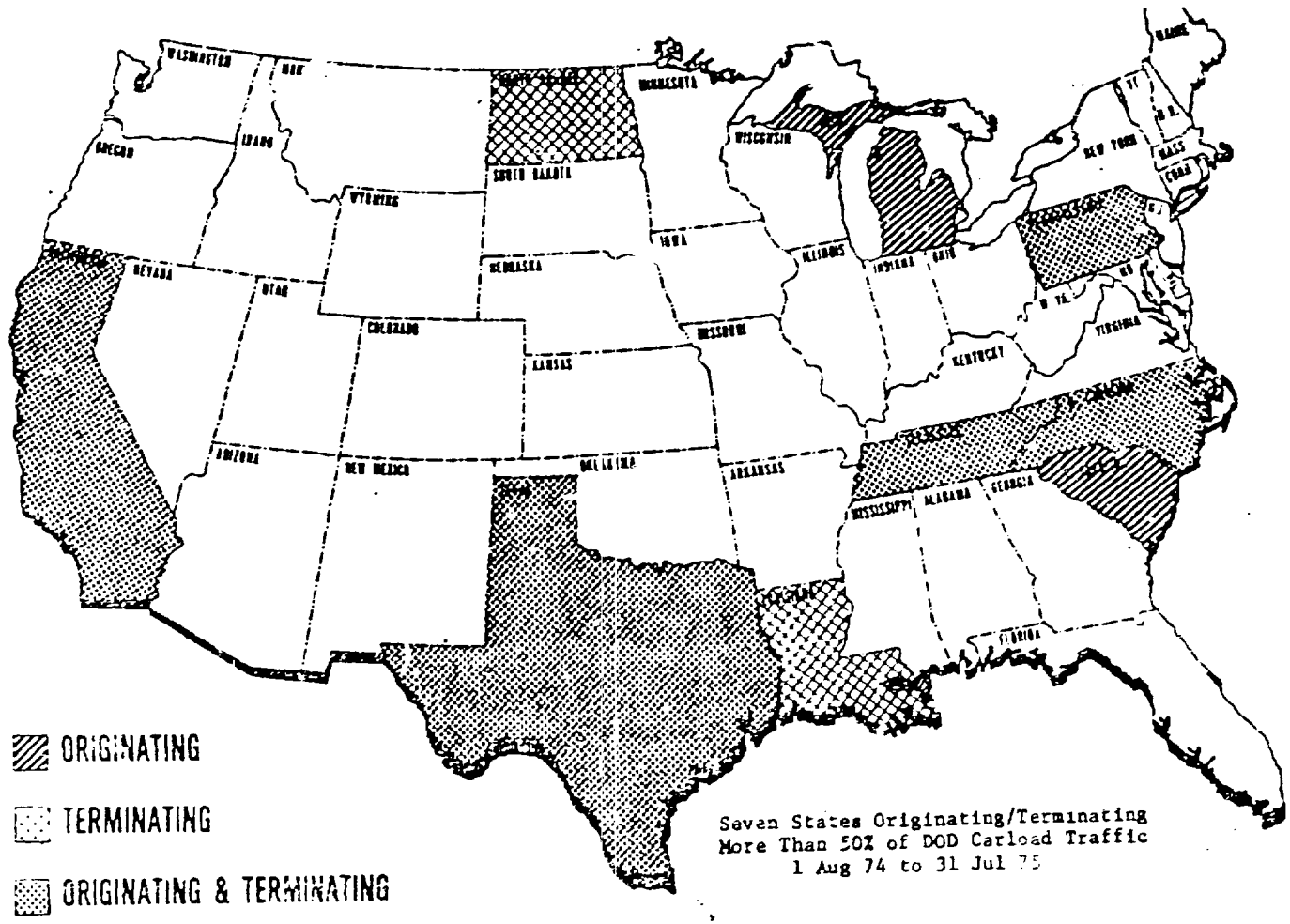
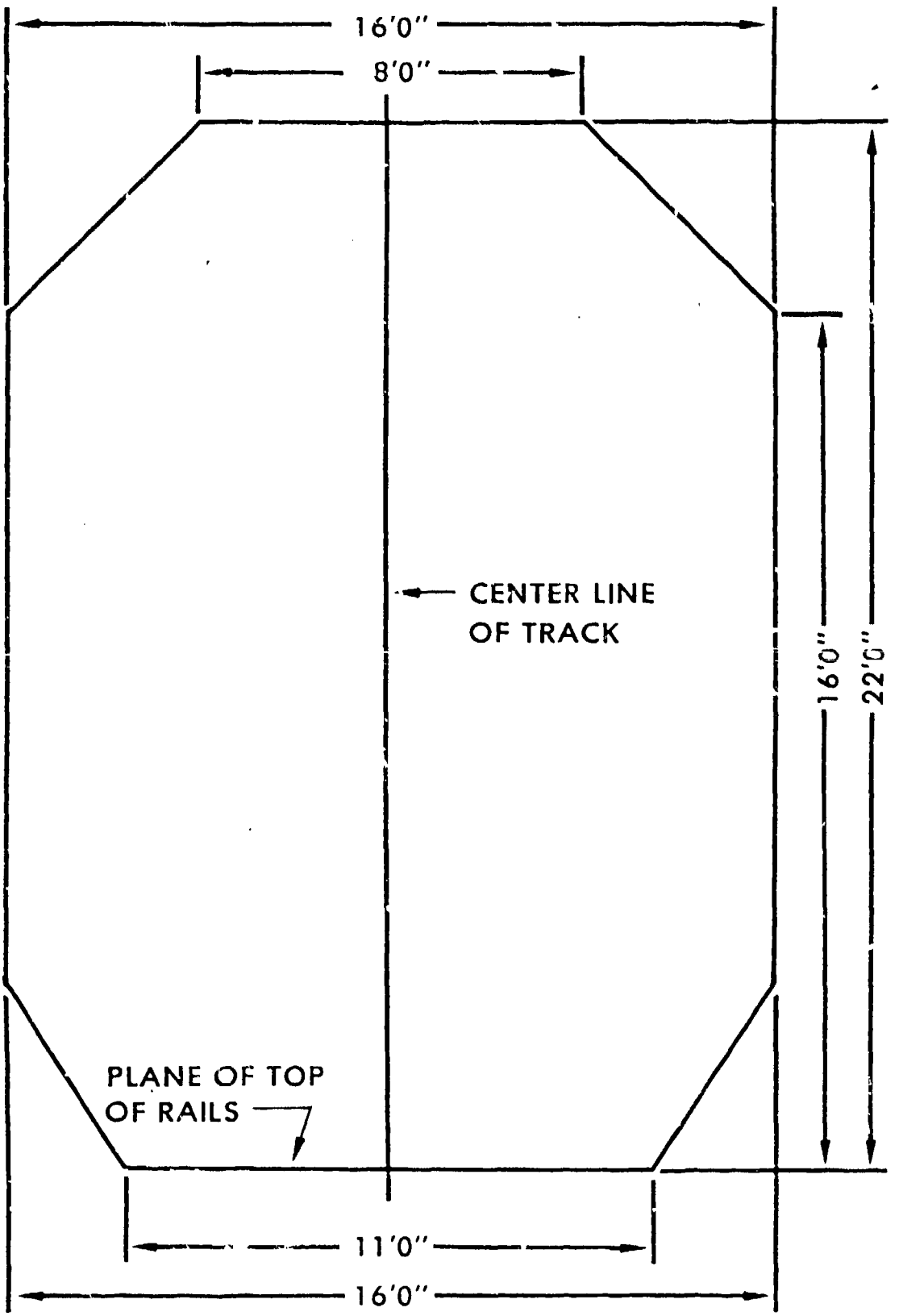


FIGURE 9
DOD Clearance Profile (73:16)



propellors, components of major missile systems (TITAN, MINUTEMAN TRIDENT), howitzers, and cranes (73:13; 31:7).

Utilizing the same data base used for the volume analysis, i.e., the base rail corridor network map, tank shipments were traced by extracting two uniform freight classifications (UFCs) on battle tanks, with and without guns. The result was a general model based on an historical file of origins, junctions, and destinations for describing clearance routes. The clearance analysis concluded with information about how the FRA was to provide programming and testing of the model (69:21).

Contingency Analysis

Since the DOD relies heavily on the Nation's rail system to support contingency requirements, MTMC's RND officials examined over 700 origin/destination pairs obtained from the Mobility Plans Division, Directorate of Plans and Operations, HQ MTMC (69:23). Although the 700 pairs were not associated with any specific plan, they were representative of general DOD requirements. The requirements were also analyzed in terms of corridors of access to ports of embarkation (POEs), rather than by volume of traffic moved.

Unlike the two previous peacetime analyses, the contingency analysis did not include actual rail carriers.

Instead, rules were established to govern a simulated movement of rail traffic between the origin/destination pairs (69:23). As a result, alternate routes were built into the system where feasible, thus providing a certain level of redundancy in the contingency network. MTMC points out that redundancy or circuitous routing also has a functional value in that by utilizing the physical distribution concept of inventories in motion, railcars can become warehouses (69:23).

Subjective Evaluation Criteria

The final area of analysis was an attempt to consider not only the objective dimensions of the network, but also the attributes that are essential for network integrity from a strategic perspective. The three attributes incorporated into the final STRACNET design were interconnectivity, service, and strategic requirements.

The concept of interconnectivity, in this sense, is concerned with the geographical cohesiveness of a rail system needed in maintaining network integrity (69:26). For our purposes an interconnected network means that all junction points must be connected to the rail system by at least one link. Since the rail system serves as one primary method of moving cargo and people during times of national emergency, the network must connect major population centers. In addition, sea and air POEs are necessary for

the rapid deployment of military forces and for providing the gateways through which defense materiel must flow (69:30). Therefore, interconnectivity was considered an important aspect of a total integrated logistics system.

Service, the second area, is used here to describe the capability of the corridor network in supporting national defense requirements (69:34). The principal question regarding service is whether the military services can be effectively served during contingencies. While the historical answer has been yes, the current levels of deferred maintenance, track abandonments, and capital shortages in the rail industry make today's answer less certain. Since contingencies create traffic surges six to twenty times greater than peacetime flows, service capability is also an important decision criteria (69:34).

The third and final subjective attribute included the strategic aspects of ensuring a sound defense posture. For example, major military supply depots must be assured of adequate rail support in meeting their required missions. As a point of reference, a listing of major supply depots can be found in Table 19. As a result of such strategic considerations, rail corridors were retained or added if they represented limited access avenues internal to the rail system or if specific activities were dependent upon them (69:34).

TABLE 19
Major Defense Depots (69:92-93)

Air Force Depots	
San Bernadino Air Materiel Area	Norton AFB, California
Oklahoma City Air Materiel Area	Tinker AFB, Oklahoma
San Antonio Air Materiel Area	Kelly AFB, Texas
Ogden Air Materiel Area	Hill AFB, Utah
Warner Robbins Air Materiel Area	Robbins AFB, Georgia
Defense Supply Agency	
Defense Depot Ogden	Ogden, Utah
Defense Depot Tracy	Lyoth, California
Defense Depot Memphis	Memphis, Tennessee
Defense Depot Mechanicsburg	Mechanicsburg, Pennsylvania
Defense General Supply Center	Richmond, Virginia
Defense Construction Supply Center	Columbus, Ohio
Army	
Red River Army Depot	Texarkana, Texas
Anniston Army Depot	Bynum, Alabama
Sierra Army Depot	Herlong, California
Tooele Army Depot	Tooele, Utah
Lexington-Blue Grass Army Depot	Ft. Estill, Kentucky
Atlanta Army Depot	Forest Park, Georgia
Pueblo Army Depot	Avondale, Colorado
Letterkenny Army Depot	Chambersburg, Pennsylvania
Seneca Army Depot	Romulus, New York
New Cumberland Army Depot	Harrisburg, Pennsylvania
Umatilla Army Depot	Ordnance, Oregon
Tobyhanna Army Depot	Tobyhanna, Pennsylvania
Navajo Army Depot	Flagstaff, Arizona
Savanna Army Depot	Savanna, Illinois
Sharpe Army Depot	Stockton, California
Marine Corps Depots	
Marine Supply Center Barstow	Nebo, California
Marine Supply Center	Albany, GA
Marine Supply Center	Philadelphia, PA
Navy	
Naval Ammunition Depot Crane	Crane, Indiana
Naval Ammunition Depot McAlester	Savanna, Oklahoma
Naval Ammunition Depot Hawthorne	Thorne, Nevada
Naval Supply Center Norfolk	Norfolk, Virginia
Naval Supply Center San Diego	San Diego, California
Naval Supply Center Charleston	Charleston, South Carolina
Naval Supply Center Oakland	Oakland, California
Naval Supply Center Puget Sound	Bremerton, Washington

STRACNET Conclusion

After analyzing and considering each of the previous criteria, and by examining FRA preliminary mainline designations, a rail corridor network strategically important to national defense was developed. Complying with Section 503(e) of the 4-R Act of 1976, DOT's FRA designated from one or more rail lines available in each STRACNET corridor, a Class A mainline to satisfy each corridor (71:8; 73:1). The result of this effort was the approximately 32,500-mile STRACNET system. MTMC chose the corridor approach over the specific routes or rail lines because: (1) it presented defense needs without advocating any individual carrier; (2) it enabled civil planners to consider the relative attributes of various railroads, as well as the needs of interstate commerce and national defense; and (3) it allowed railroad planners to integrate defense requirements into civil railroad plans with maximum flexibility (73:10-11).

Installations Requiring Rail Service and the Designation of Connector Lines

Another initial effort of the RND Program was MTMC's publication of a list identifying DOD installations requiring rail service to accomplish their assigned missions (69). Identified by each defense installation, the rail service requirements are submitted through appropriate

command channels to the respective military service headquarters for validation, and finally to MTMC for screening on behalf of DOD (73:8). The command channel review process and the military service headquarters elements are illustrated in Figure 10 and Table 20, respectively. Examples of factors considered during the MTMC screening process include: (1) rail traffic generated during peacetime and/or mobilization; (2) any front line units required to be outloaded; (3) oversize or outsize/overweight equipment to be outloaded; (4) the installation's wartime expansion mission; (5) other transportation modes available; and (6) the location and type of the defense facility (73:8). Initially published in March 1977, the list is updated on a three to four year frequency, with the latest issue published in March 1981. See Table 21 for USAF bases.

In addition to the broad corridors and mainlines identified by the original STRACNET, branch or connector lines serving various defense installations were also considered important to national defense. As a result of this realization and in accordance with the Staggers Rail Act of 1980, MTMC identified in 1981, an additional 5,000 miles of connectors to further enhance STRACNET (73:11; 71:19). The following selection criteria were used to choose the best route when two or more potential routes serving an installation existed: (1) the primary POE for

FIGURE 10
Command Channel Review
DOD Installations
Requiring Rail Service (71:9)

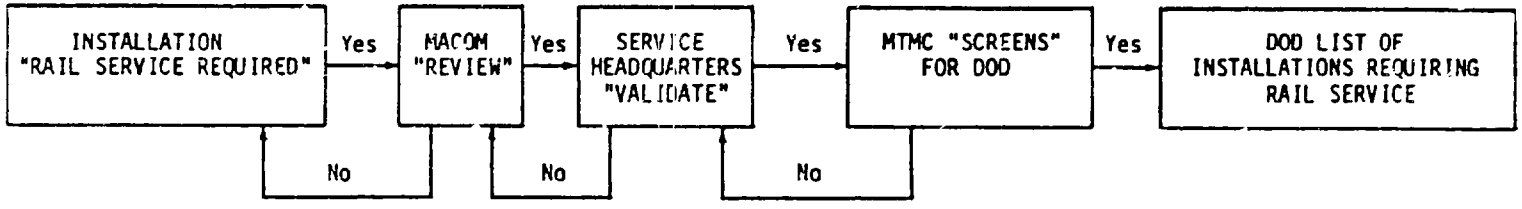


TABLE 20
RND Liaison Offices (71:10)

DEPARTMENT	OFFICE
Army	Deputy Chief of Staff for Logistics Strategic Mobility Division (DALO-TSM)
Navy	Naval Supply Systems Command Transportation, Systems Division (NAVSUPSYSCOM-052)
Marine Corps	Director Facilities & Service Division Transportation Branch (MG-LFT)
Air Force	Deputy Chief of Staff Logistics and Engineering Directorate of Transportation (AF-LET)
Defense Logistics Agency	Executive Directorate Supply Operation, Transportation Division (DLA-O)

TABLE 21
Air Force Installations
Requiring Rail Service (73:20)

ACTIVITY	LOCATION
Altus Air Force Base (AFB)	Altus, OK
Arnold Engineering Development Center	Tullahoma, TN
Barksdale AFB	Bossier City, LA
Beale AFB	Erle, CA
Cape Canaveral Air Force Station	Wilson, FL
Carswell AFB	Fort Worth, TX
Charleston AFB	Charleston, SC
Davis-Monthan AFB	Tucson, AZ
Ellsworth AFB	Rapid City, SD
F. E. Warren AFB	Cheyenne, WY
Fairchild AFB	Fairchild, WA
Grand Forks AFB	Emerado, ND
Griffiss AFB	Rome, NY
Hill AFB	Ogden, UT
Holloman AFB	Alamogordo, NM
Kelly AFB	San Antonio, TX
Kingsley Field	Spring Lake, OR
Kirtland AFB	Albuquerque, NM
Loring AFB	Limestone, ME

TABLE 21 (continued)

ACTIVITY	LOCATION
Malmstrom AFB	Great Falls, MT
McClellan AFB	Sacramento, CA
McQuire AFB	Wrightstown, NJ
Minot AFB	Minot, ND
Moody AFB	Valdosta, GA
Mt. Home AFB	Mt. Home, ID
Nellis AFB	Las Vegas, NV
Otis AFB	Falmouth, MA
Plattsburg AFB	Plattsburg, NY
Pope AFB	Fayettsville, NC
Seymour Johnson AFB	Goldsboro, NC
Shaw AFB	Sumter, SC
Tinker AFB	Oklahoma City, OK
Travis AFB	Fairfield, CA
Vance AFB	Enid, OK
Vandenberg AFB	Lompoc, CA
Robins AFB	Warner Robins, GA
Whiteman AFB	Knobnoster, MO
Wright Patterson AFB	Dayton, OH
Wurtsmith AFB	Oscoda, MI

units located at the installation; (2) the shortest distance to the designated STRACNET mainline; (3) total civil and defense traffic volume to determine the economic viability of the line; (4) preference for through-routing by a carrier originating traffic at the installation; (5) clearances required for oversized/outsized shipments; (6) rail line clearances available; and (7) current and anticipated rail line abandonments (71:19). A summary breakout of the 216 DOD installations requiring rail service is listed on Table 22. In addition, area maps of those USAF installations which have been identified due to light density traffic, as facing potential rail line abandonment are included in Figures 11 through 24. Also shown in Figure 25 is the resulting (and the most current) STRACNET system.

The 1981 STRACNET Condition Report

The final evidence of DOD rail concerns is the STRACNET Condition Report published in June 1981 (73). This report was the result of a Congressional mandate (Section 811 of the Staggers Act), which required the Secretary of Defense to analyze rail lines important to national defense, identify deficiencies, and estimate the cost of correcting the deficiencies. The law further required that the Secretary of Defense, in consultation with the Secretary of Transportation, make recommendations to

TABLE 22
DOD Installations
Requiring Rail Service (70:6-7)

Served by	Army	Navy	Marines	Air Force	Defense Logistics Agency	Total
STRACNET	39	11	5	13	8	76
CONNECTORS:						
Mainline	42	6	1	9	7	65
Branchline	27	20	4	17	7	75
TOTAL:	108	37	10	39	22	216

FIGURE 11
Georgia STRACNET Lines (73:51)

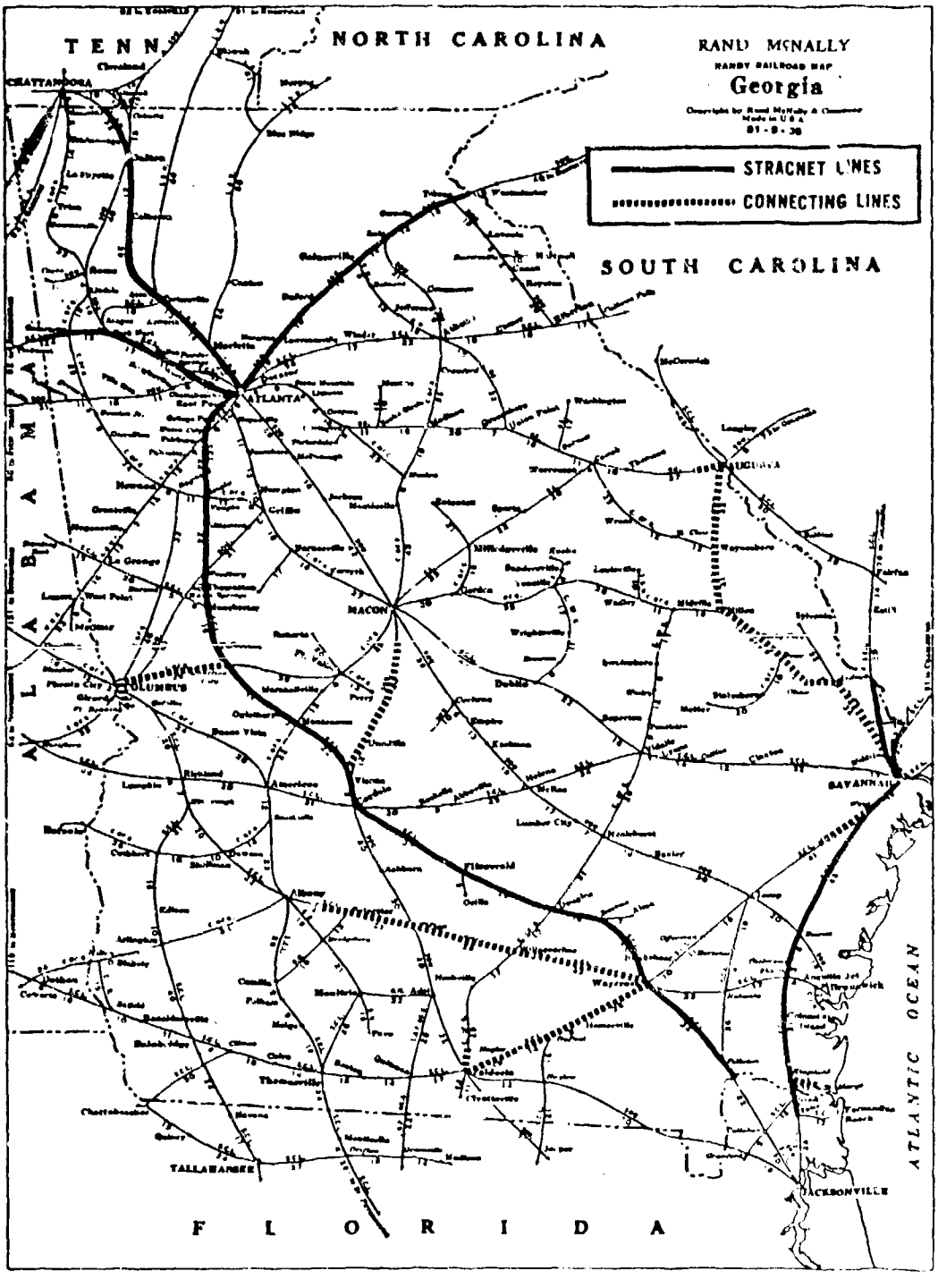


FIGURE 12
Maine STRACNET Lines (73:59)

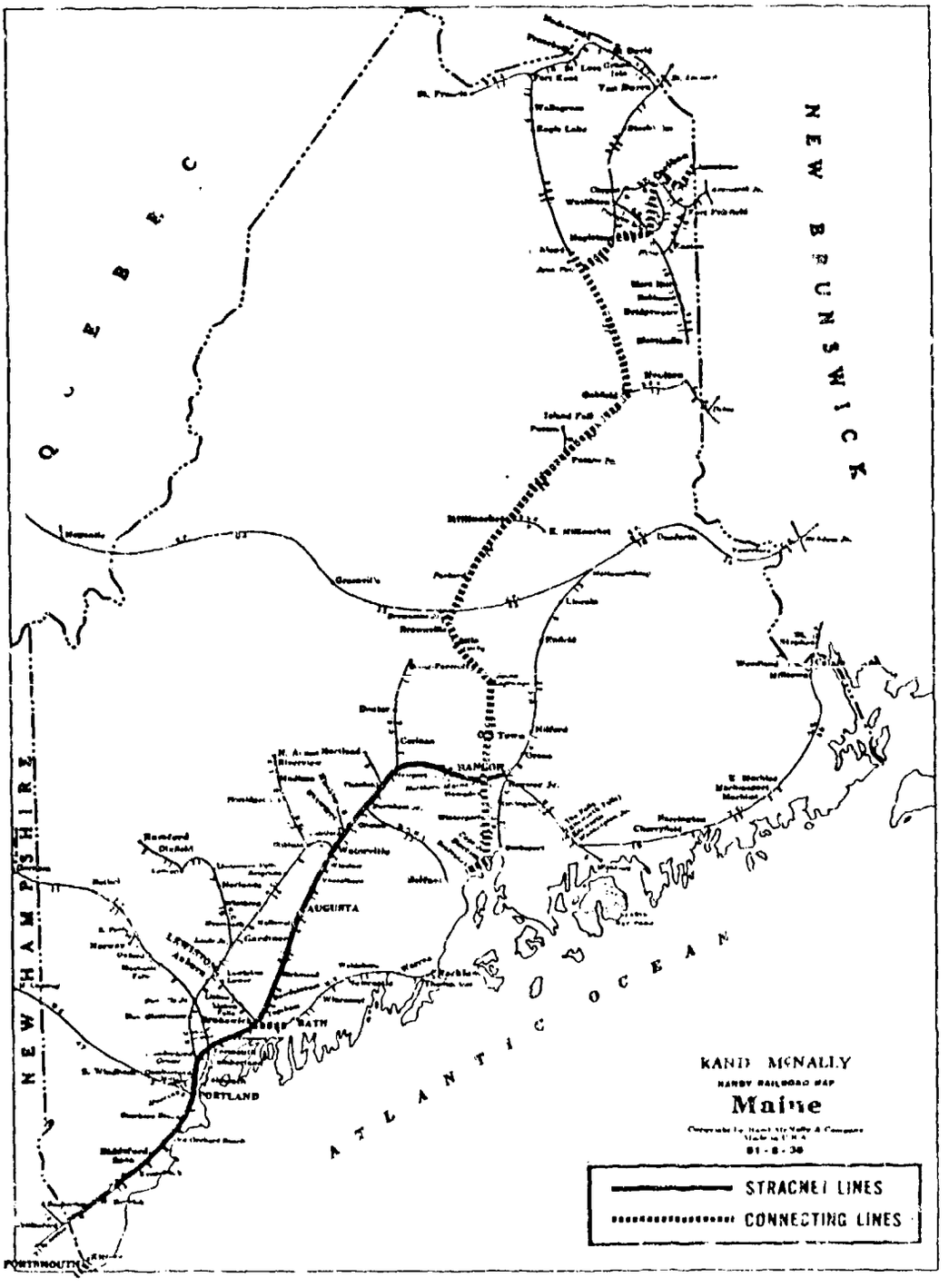


FIGURE 13
Massachusetts STRACNET Lines (73:61)

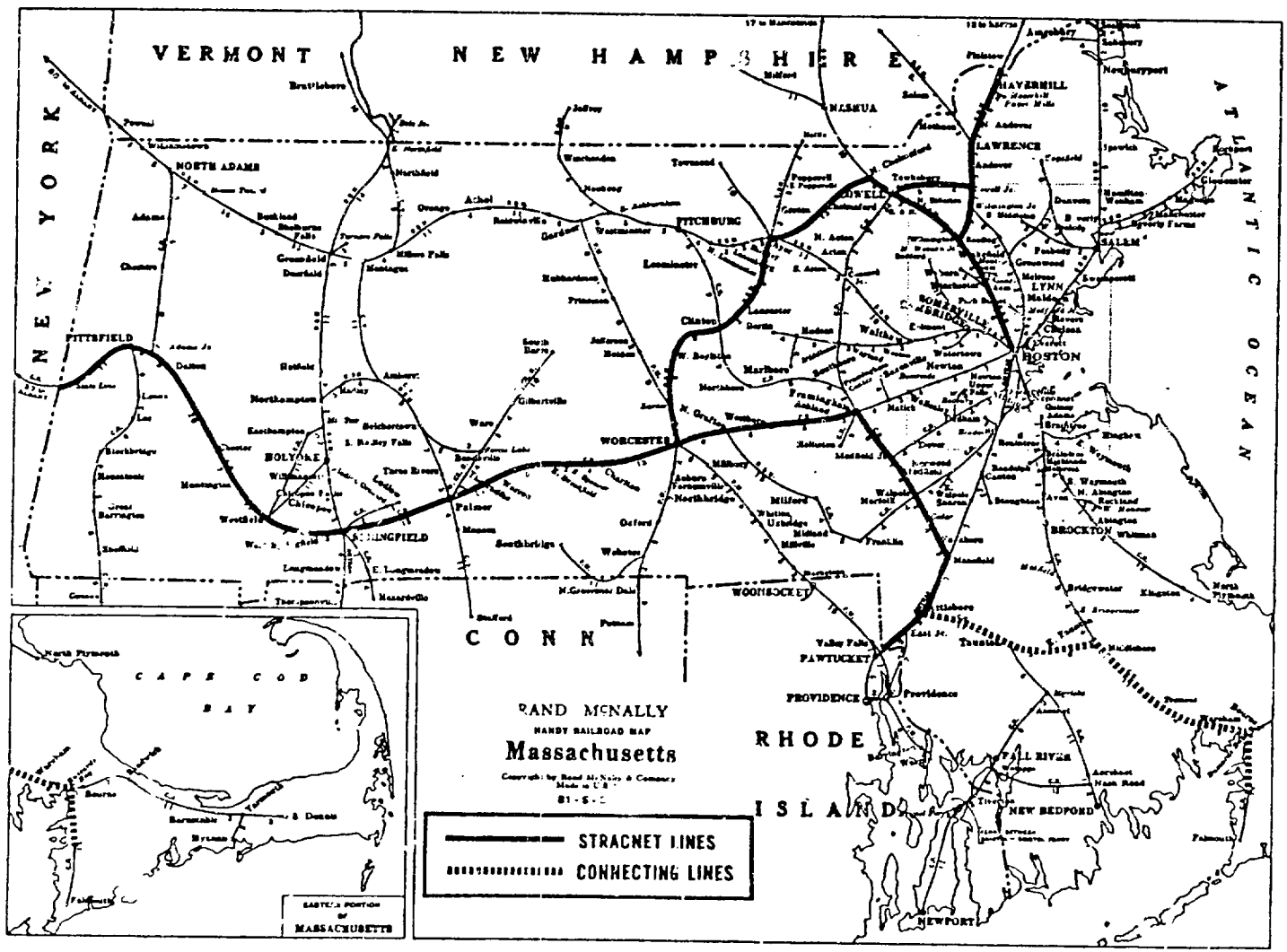


FIGURE 14
Michigan STRACNET Lines (73:62)

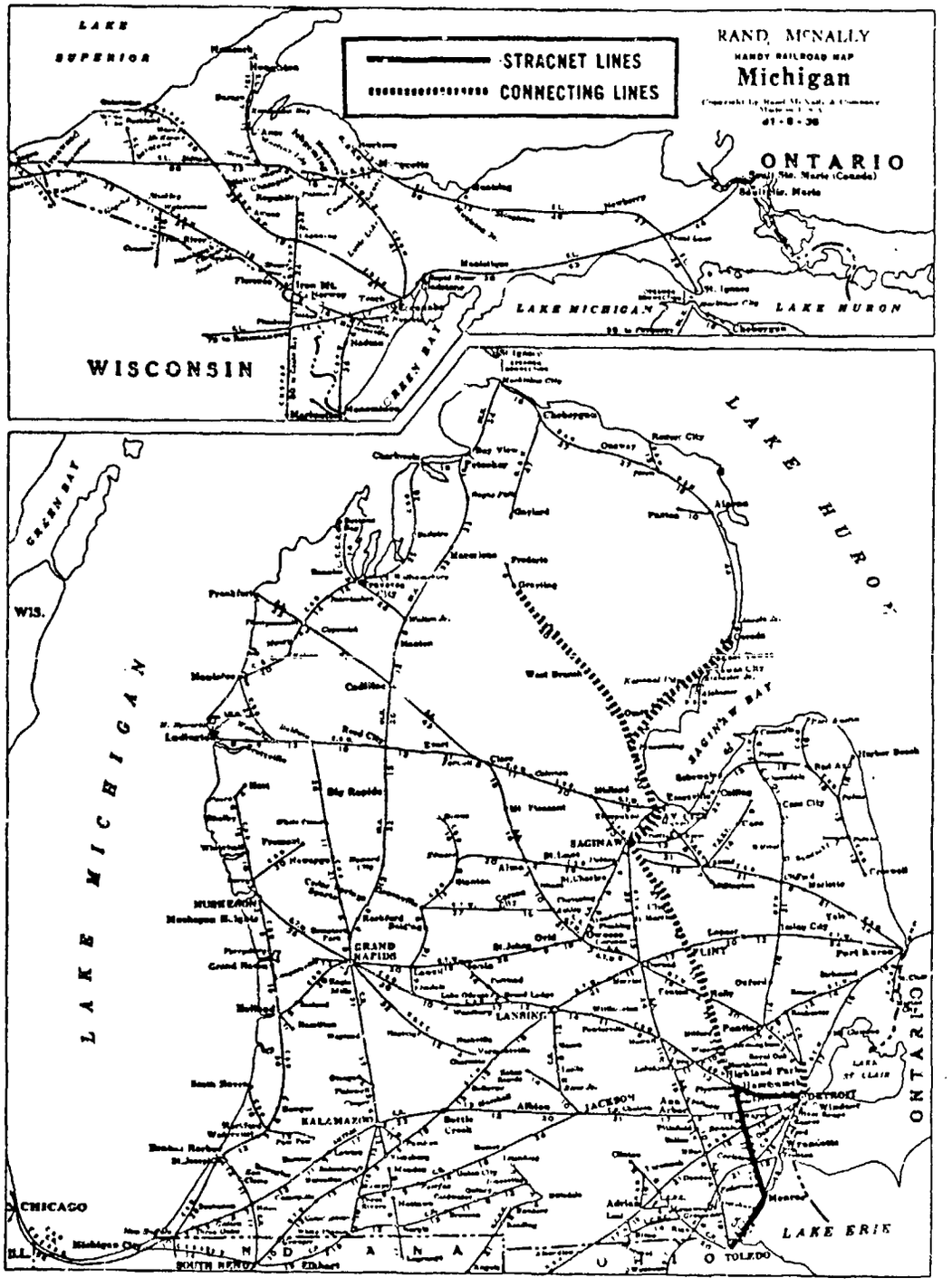


FIGURE 15
Montana STRACNET Lines (73:66)

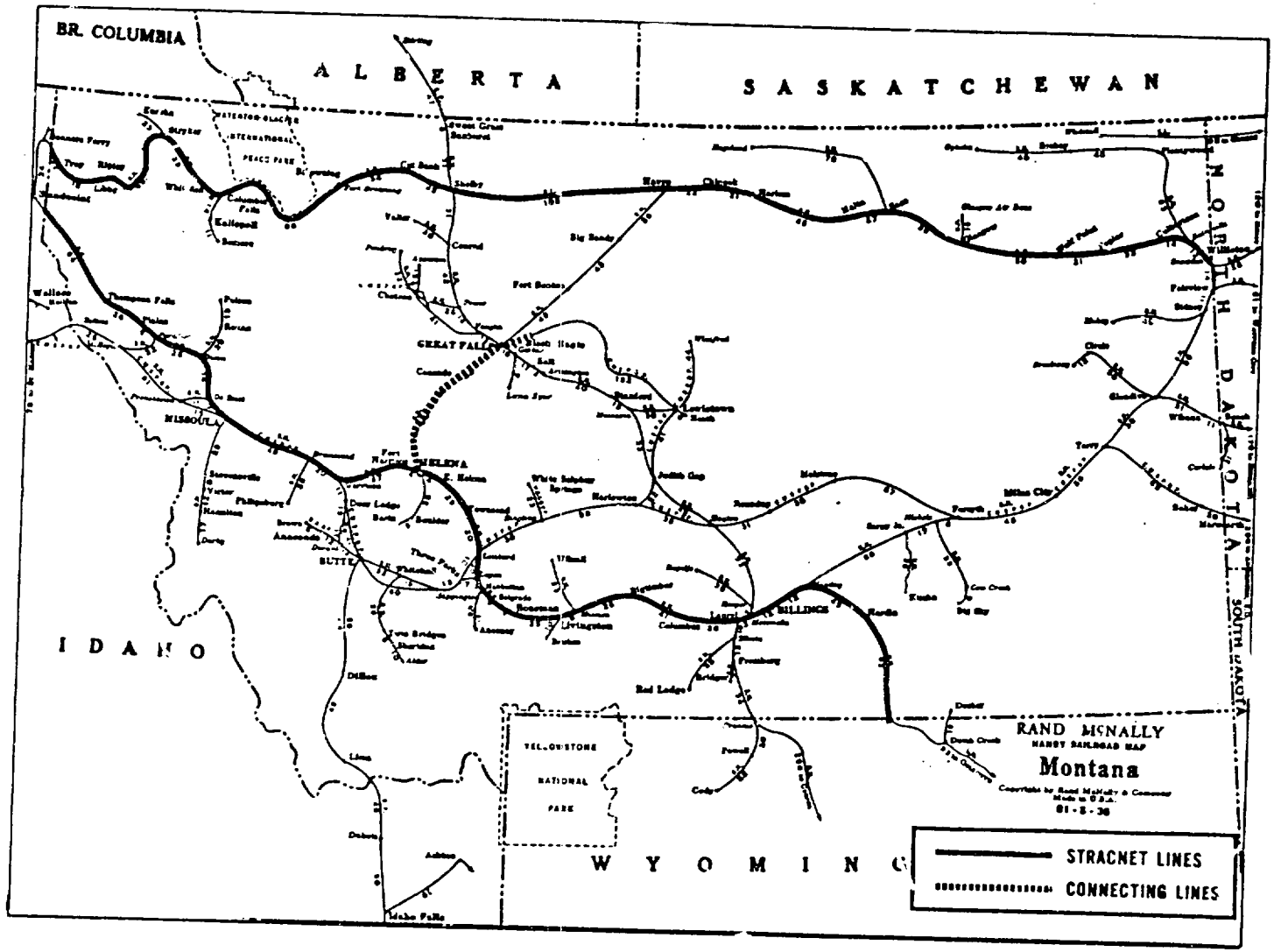


FIGURE 16
New Jersey STRACNET Lines (73:70)

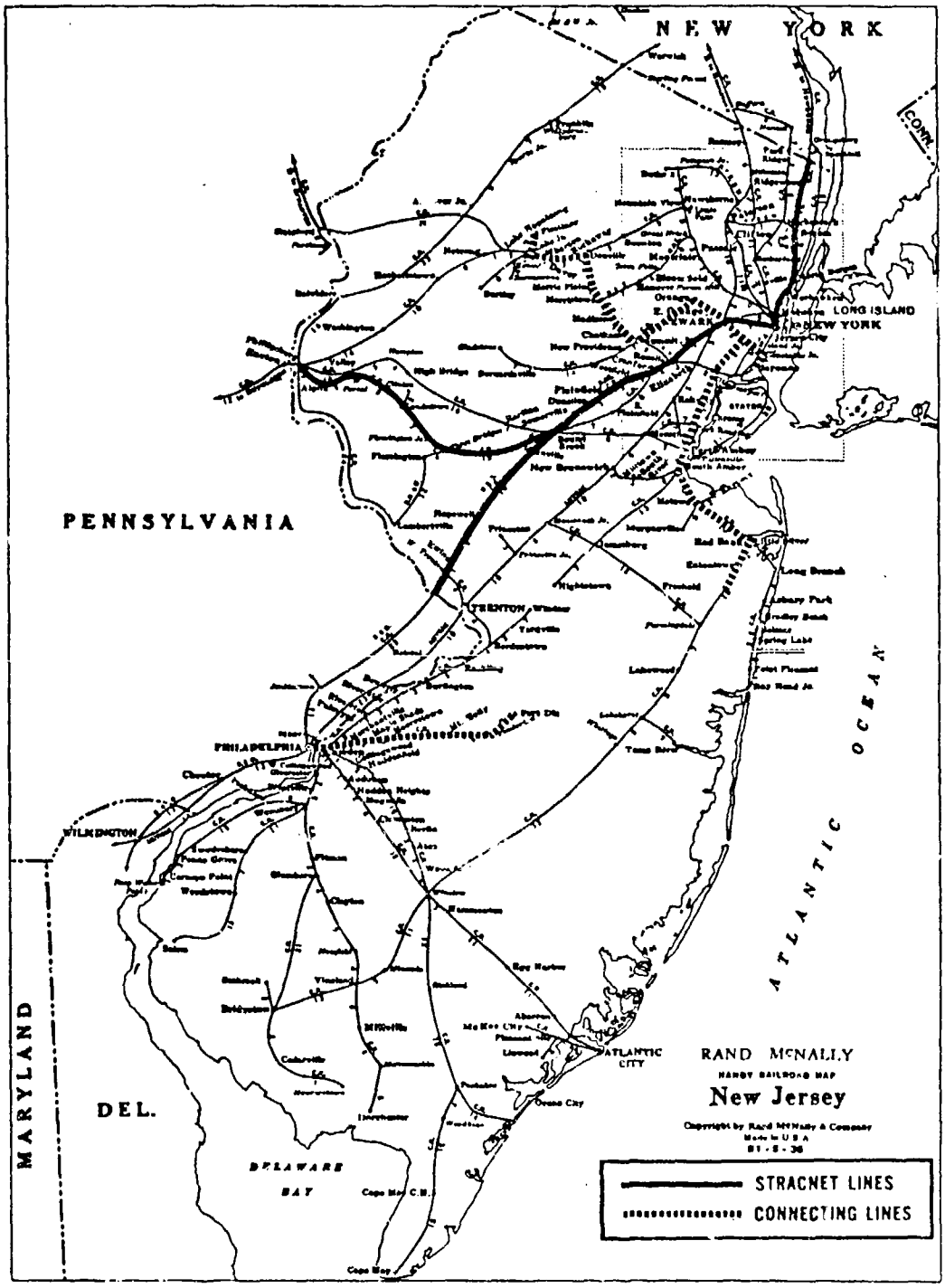


FIGURE 17
New Mexico STRACNET Lines (73:71)

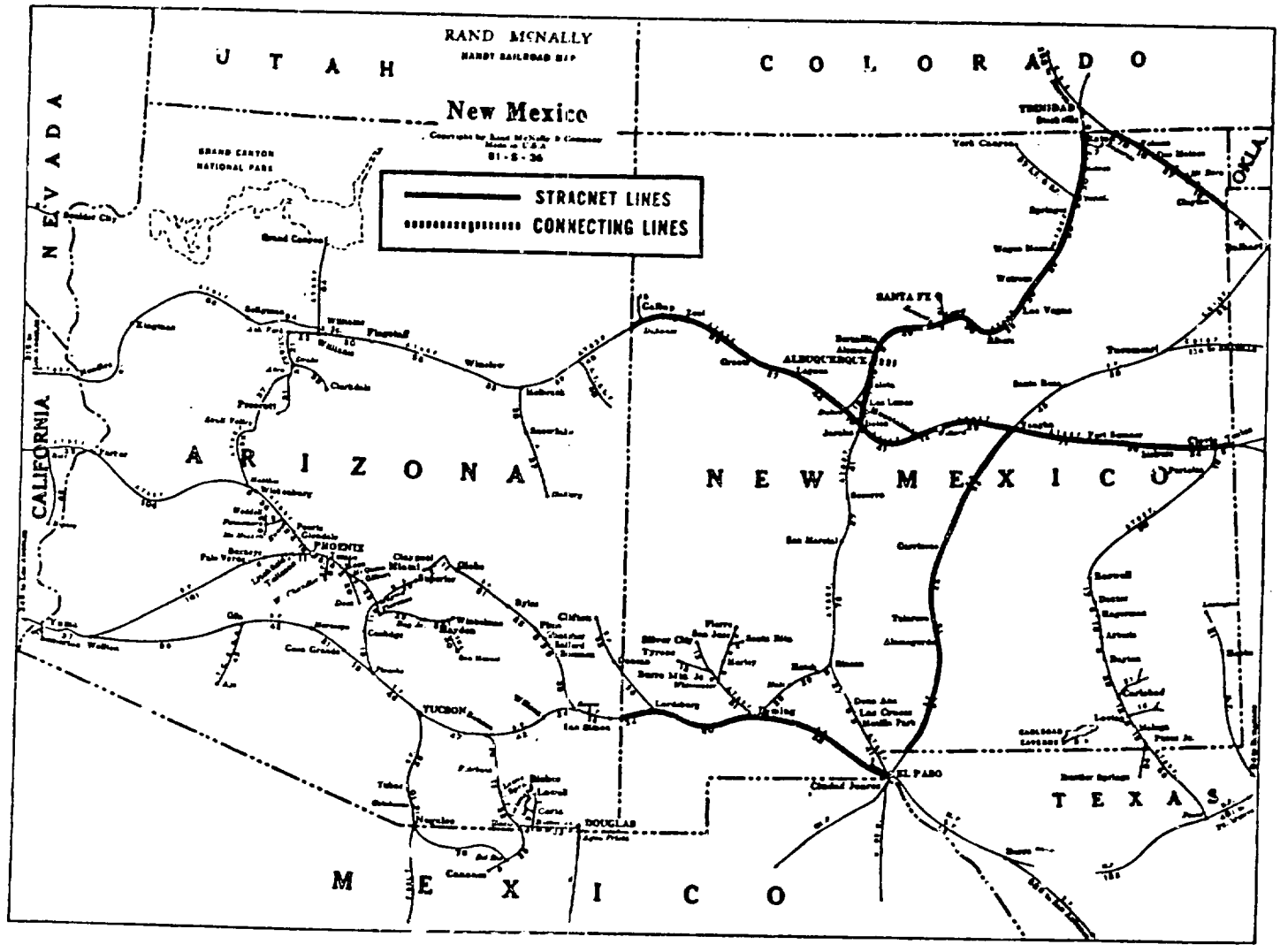


FIGURE 18
North Carolina STRACNET Lines (73:73)

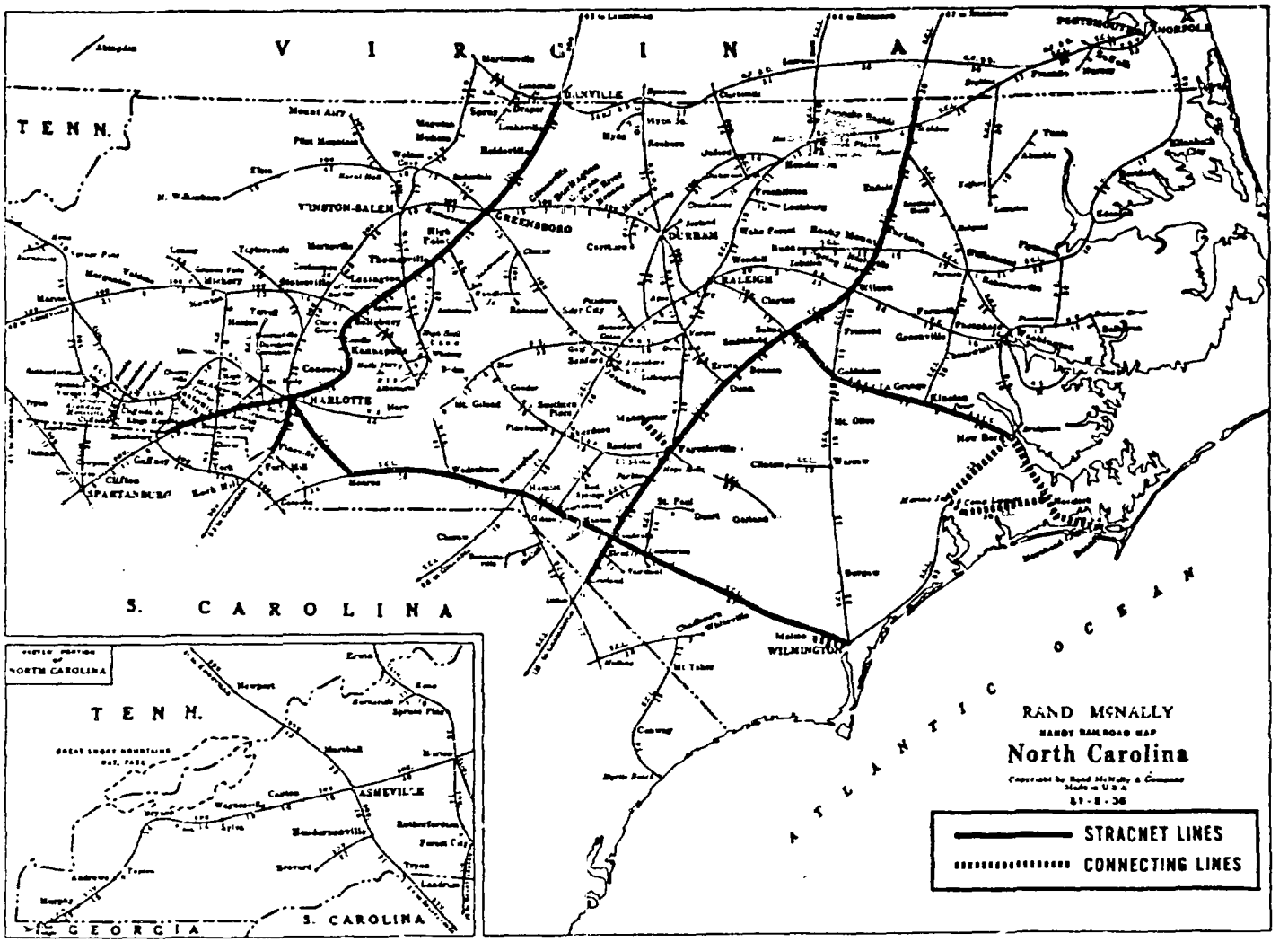


FIGURE 19
North Dakota STRACNET Lines (73:74)

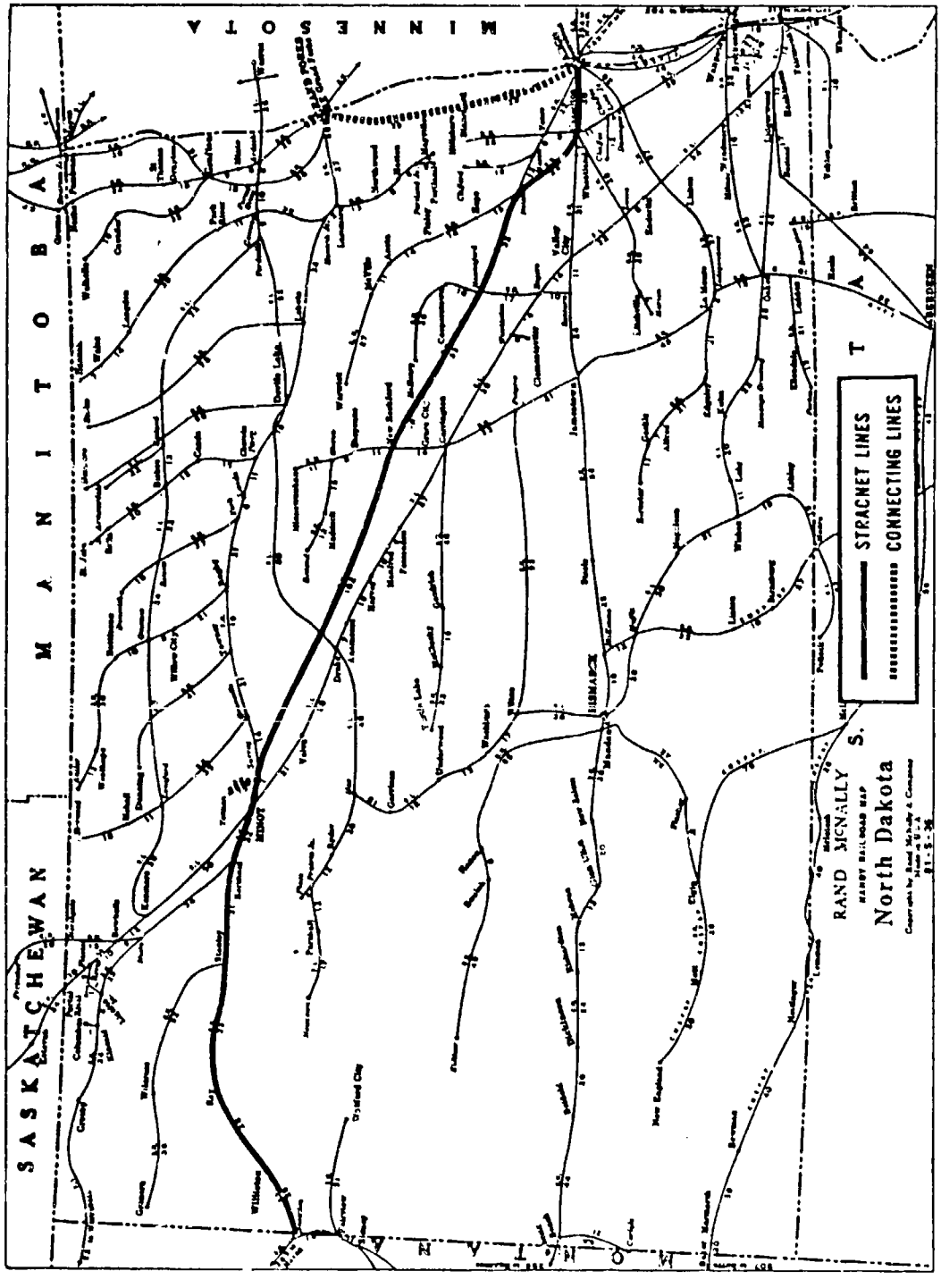


FIGURE 20
Oklahoma STRACNET Lines (73:76)

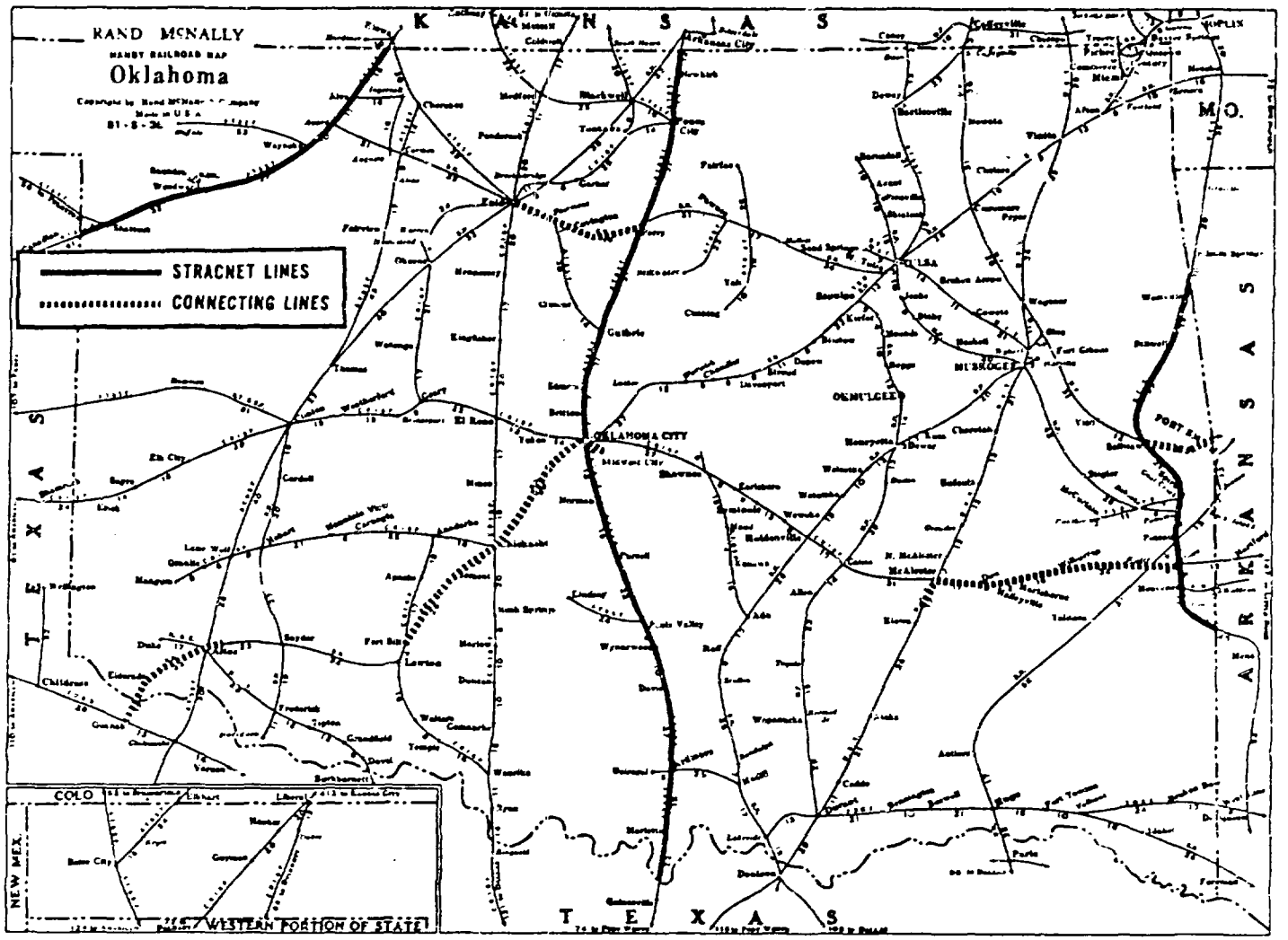


FIGURE 21
South Dakota STRACNET Lines (73:81)

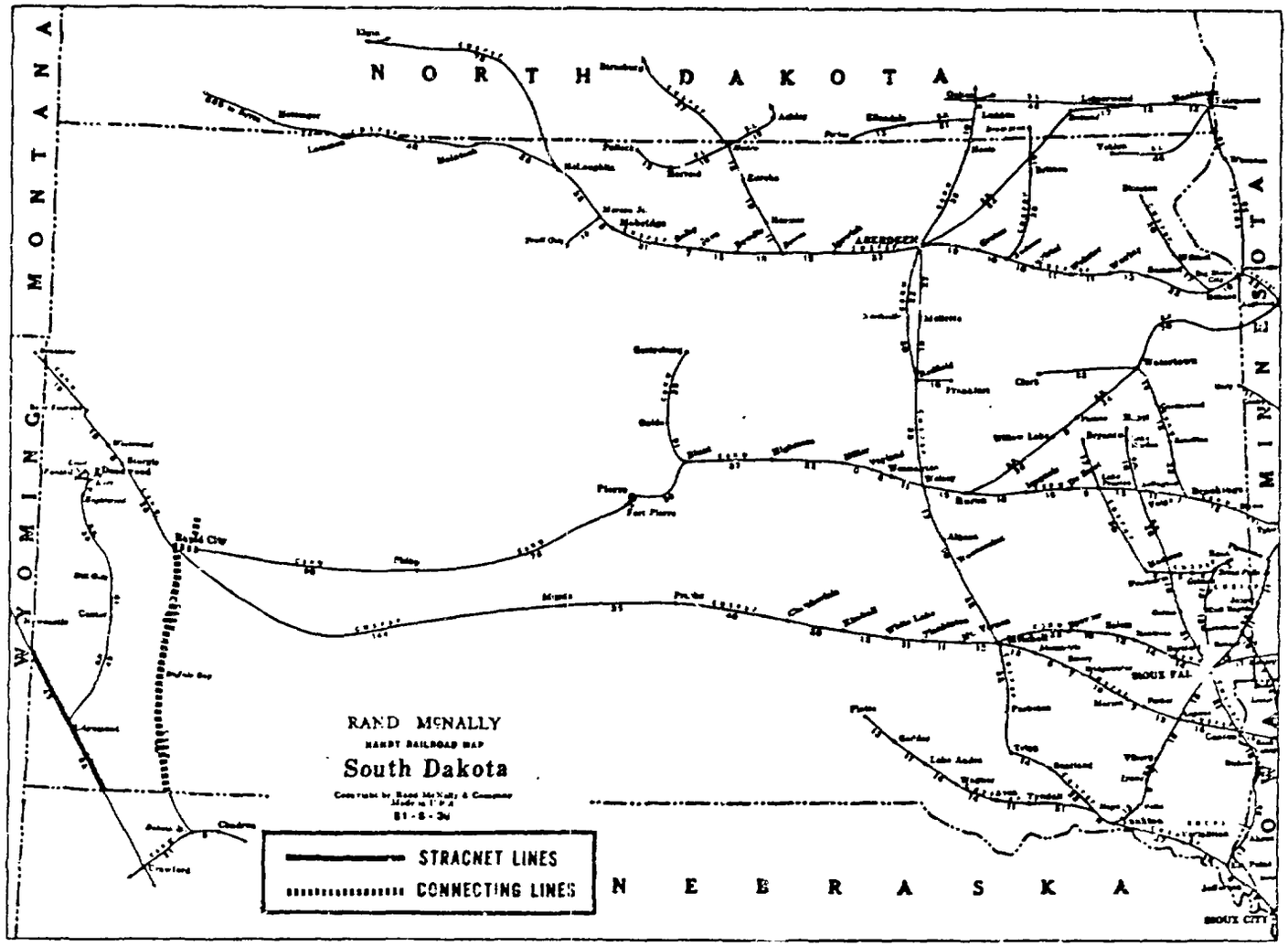


FIGURE 22
Tennessee STRACNET Lines (73:82)

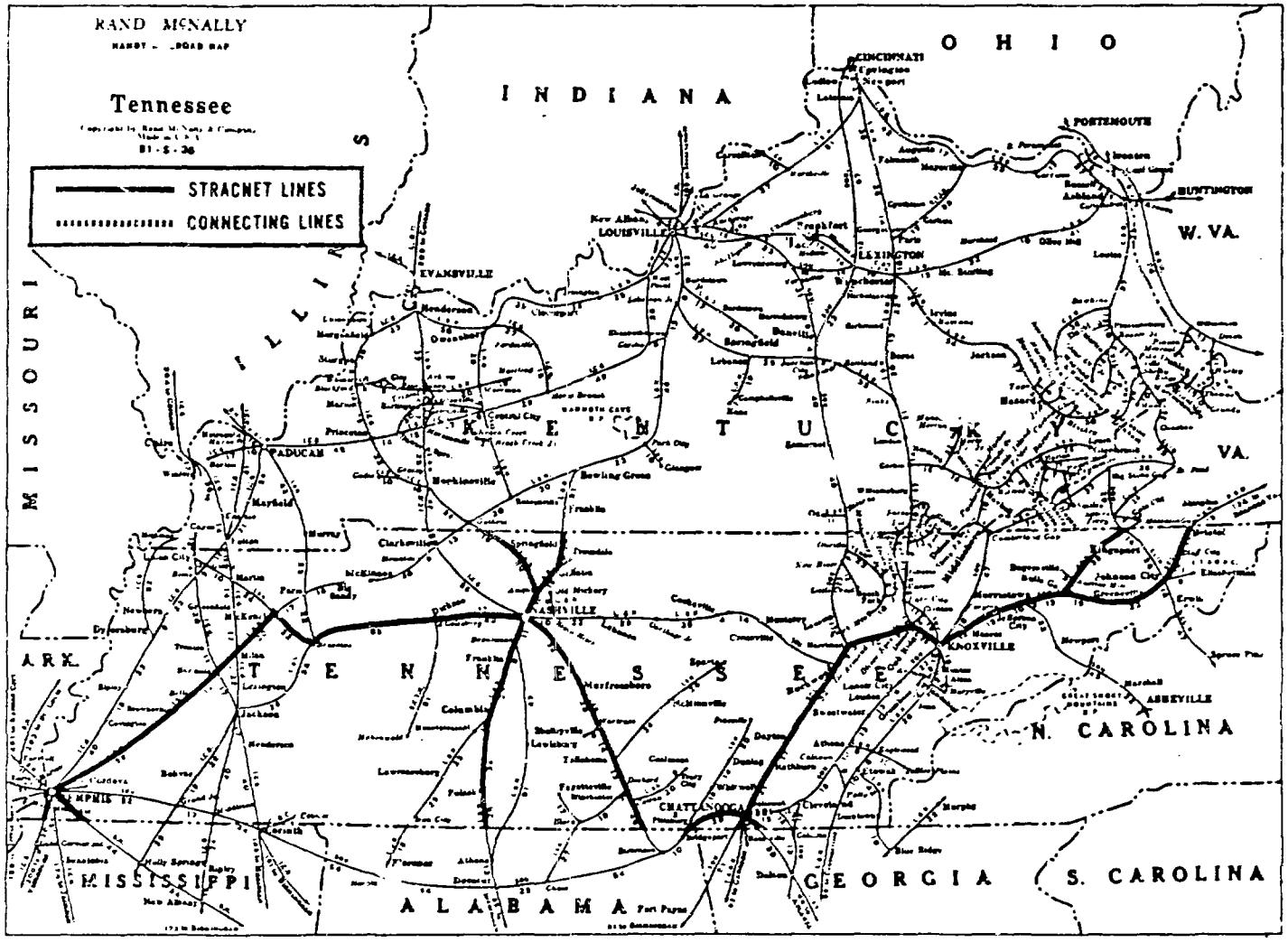


FIGURE 23
Texas STRACNET Lines (73:83)

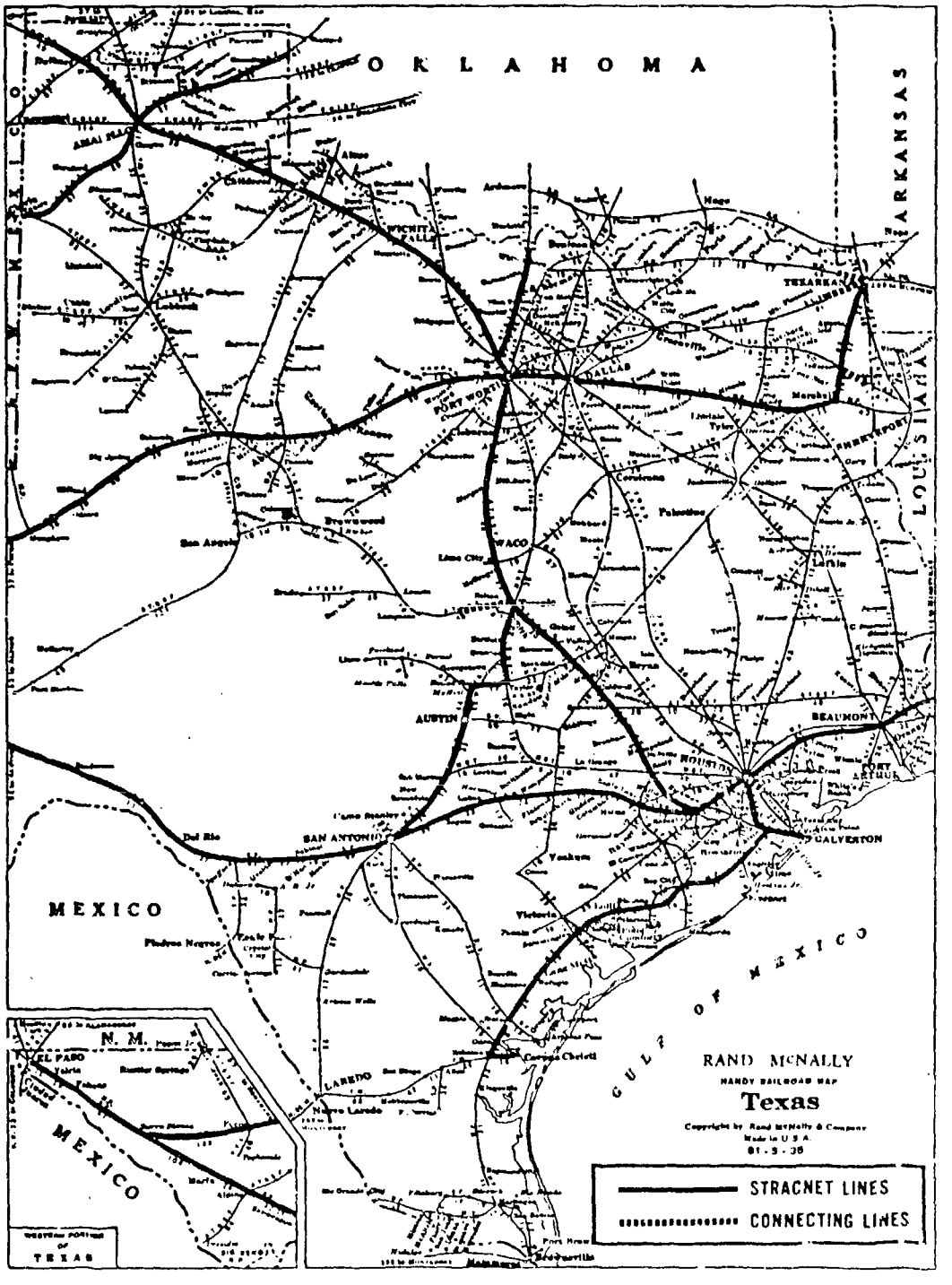


FIGURE 24
Utah STRACNET Lines (73:84)

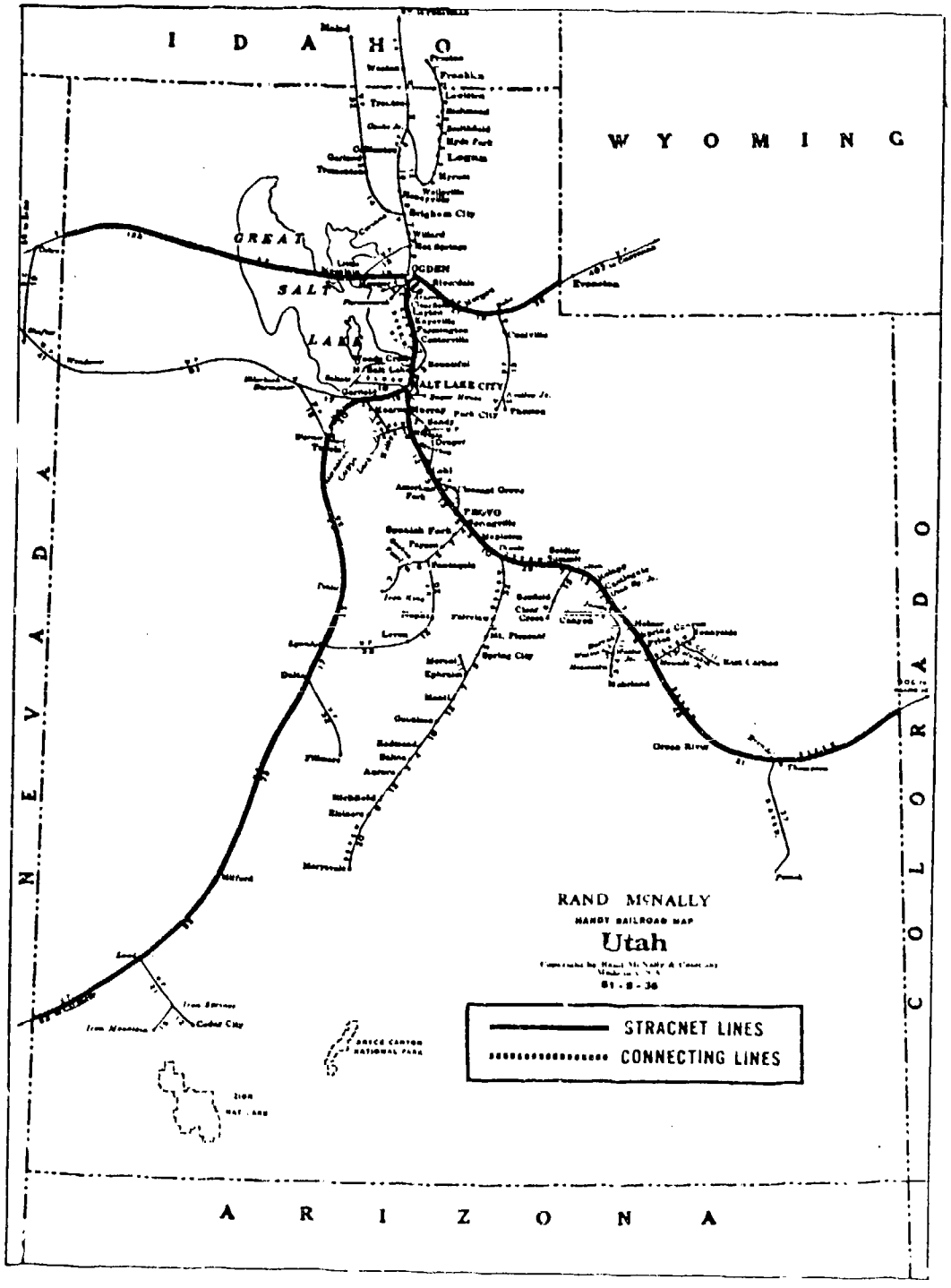
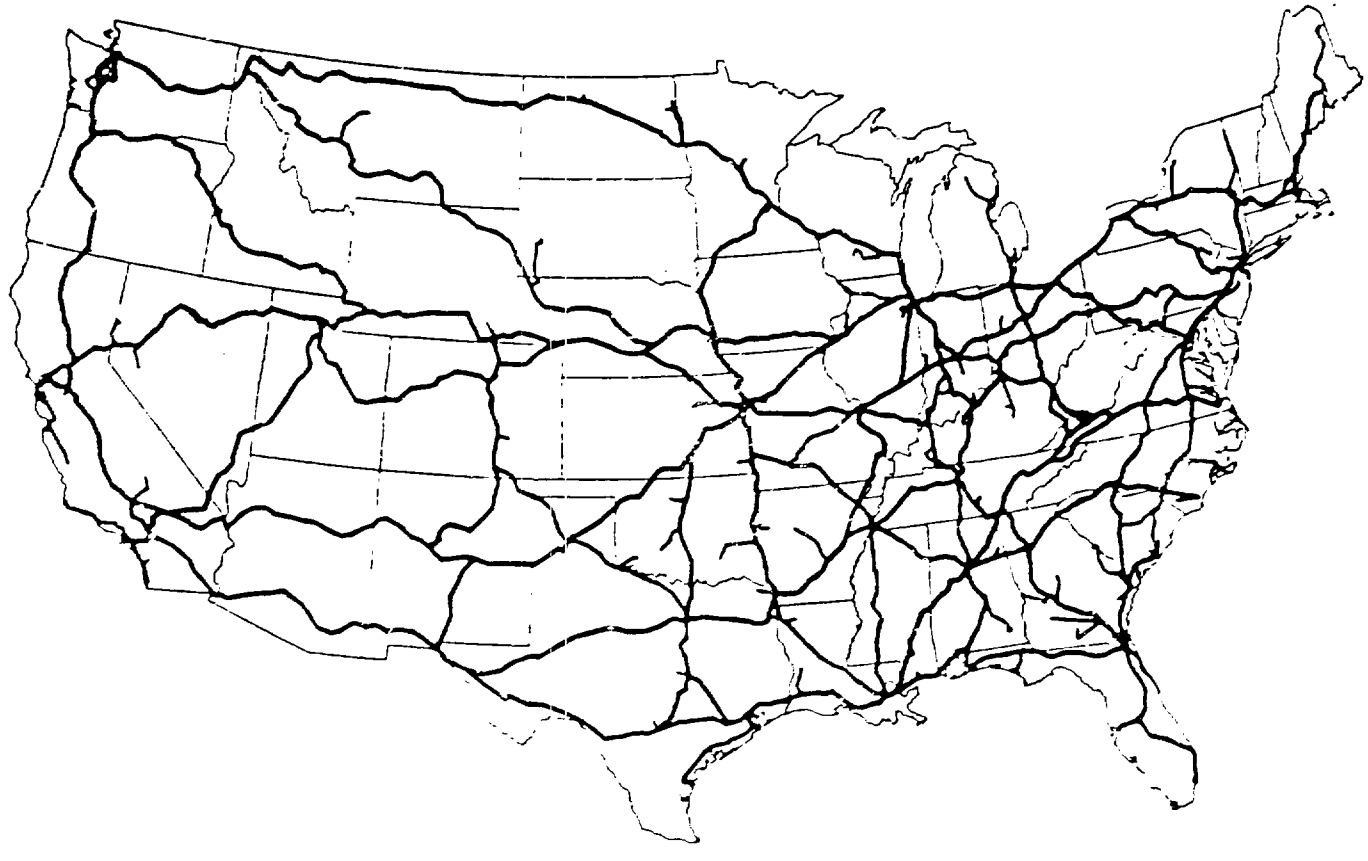


FIGURE 25
Current STRACNET System (73:22)

RAIL LINES IMPORTANT TO NATIONAL DEFENSE



LEGEND:

STRACNET

CONNECTORS

correct the deficiencies and submit a report to the Congressional Armed Services Committees not later than 1 July 1981 (73:5). As the single-manager for DOD surface transportation, MTMC was delegated the responsibility for conducting the study and examining two specific rail conditions--rail line clearances and rail line maintenance (73:2).

The findings from MTMC's rail line clearance study revealed that all but five of the mainlines designated for STRACNET could accommodate the DOD clearance profile for oversized loads (71:11). Table 23 contains a description of the specific problems encountered with each of the five eastern lines. In addition to the STRACNET finding, a second finding showed that the majority of all the Nation's rail lines could accommodate DOD's clearance profile, especially outside the Northeast (71:11). As a result, most defense shipments can move by alternate routes and are not restricted by clearance requirements to the use of designated defense lines, i.e., STRACNET is not a guide to routing. However, the importance of STRACNET lines, relative to all other rail lines, warrants priority restoration of service if any national emergency results in line damage (71:11).

TABLE 23
Clearance Analysis Problems (73:93-95)

	LINE	PROBLEM	ALTERNATIVE
1.	Bluefield, WV to Iaegar, WV	Tunnels	Bluefield, WV to Richlands, VA to Devon, WV
2.	Richlands, VA to St.Paul, VA	Tunnels	Roanoke, VA to Radford, VA to Bristol, TN to Johnson City,TN to Bulls Gap, TN
3.	Petersburg, VA to Richmond, VA to Washington, DC	Bridges	Petersburg, VA to Lynchburg, VA to Washington, DC
4.	Boston, MA to Province, RI	Clearance	Mansfield, MA to Walpole, MA to Framingham, MA to Worcester, MA to
5.	Boston, MA to Albany, NY	Clearance	Clinton, MA to Ayer, MA to North Chelmsford Lowell, MA to Wilmington, MA

The second criterion to be examined was rail line maintenance. The measures of maintenance conditions are included in Table 24. Relying on these speed timetables and FRA track safety standards, MTMC's analysis revealed that 95 percent of the STRACNET mainlines permit speeds greater than or equal to 40 miles per hour and that 91 percent of branchlines could accommodate speeds greater than or equal to 25 miles per hour. As a result, the maintenance condition of the STRACNET lines was found to be acceptable for national defense needs and rail carriers were notified

TABLE 24
Track Safety - Speed Limits (73:23)

Track Safety Classification	I	II	III	IV	V	VI
Maximum Freight Train Speed--mph	10	25	40	60	80	110

of the improvement required for any deficient lines so that corrective action could be incorporated in the carrier's track maintenance programs (71:13). While on-site track inspections would have resulted in more accurate maintenance conditions, the Pentagon planners rejected this method because of the excessive time required (91:14).

In concluding this section on DOD rail concerns, it should be noted that the 1981 STRACNET Condition Report is not the "final word." MTMC has also published a draft report outlining specific methods for confronting abandonments of rail service to military installations (71). Those procedures are discussed in MTMC Report XXXX, Department of Defense Options and Procedures for Civil Rail Line Abandonments Affecting Military Installations Requiring Rail Service.

APPENDIX E

ABANDONMENT ALTERNATIVES

Abandonment Alternatives

This appendix supplements the first section of Chapter II, the literature review. The topics of concern are selected abandonment options suggested by MTMC.

State Retention

Historically, contracts which provided for state operation of troubled railroads included provisions for a management fee. This fee was set at certain percentages of the revenue attributable to the branchline. In determining the numerical value of the fee, studies revealed that the net income of all Class I railroads averaged 4.34 percent of operating revenues and that the expected performance of Conrail over its first ten years would yield 4.68 percent of revenues. Therefore, the federal government's Rail Services Planning Office (RSPO) concluded that a reasonable management fee would be 4.5 percent of revenues (8:24).

The Association of American Railroads (AAR), however, proposed 20 percent, arg ing that the 4.5 percent figure was calculated during a period when 20 percent of the national rail system was in bankruptcy or was acting under directed service provisions by the ICC. The states found 4.5 percent acceptable but also argued for incentive formu ations and application of excess revenues for line

maintenance or acquisition (8:24). The RSPO clarified the issue by stating that the 4.5 percent was a bottom or base value. As such, an operator of subsidized service should not receive less than that amount.

To rank the eligible lines, an index was used that typically included such factors as (7:2):

1. Projected increase in fuel consumption;
2. Projected increase in air pollution;
3. Projected number of jobs lost;.
4. Projected wages lost;
5. Projected taxes lost;
6. Projected sales lost;
7. Projected increase in consumer prices;
8. Historical number of cars shipped or received;
9. Operating cost of alternative modes;
10. Subsidy required to continue operation.

The index provided a means of aggregating a number of diverse but seemingly obvious impacts into one number, thereby enabling planners to develop a ranking of the lines in the relatively short time required by the 3-R Act.

However, recent studies have indicated that rail abandonment has had little or no effect on a number of the variables included in the indices. The results of th available studies that have examined actual, rather than potential impacts, strongly suggest that any of the

communities' and firms' factors may not be relevant for many branchlines. Also, the index factors failed to distinguish net effects from gross effects. This, in turn, led to double counting of benefits (7:3).

Instead of indexing, a benefit-cost ratio would have been the most useful decision tool for determining whether or not to retain a branchline. The ratio for retaining the line rather than abandoning it would be defined as the net additional product transportation and handling cost of abandoning the line divided by the net additional cost of retaining the line. The net additional transportation and handling costs incurred if the line is abandoned include (7:3):

1. Net additional trucking costs to or from a nearby rail station, or to or from market if this is less expensive than trucking to the nearby rail station;

2. Net additional rail transport costs to or from the market (increased or decreased rail rates) if the product is trucked to or from a nearby rail station;

3. Net change in product handling costs;

4. Net change in shipper or receiver facility costs;

5. Net change in product value if the product is shipped to a different market after abandonment;

6. Net change in highway maintenance costs from the increased trucking.

Other appropriate costs that could be added to the ratio's numerator include (7:3):

1. Rail line operating deficit, net of ownership costs;

2. Annualized present value of the upgrading costs to the appropriate class level, net of salvagable materials;

3. Annualized present value of land and salvage materials forgone if the line is retained rather than abandoned.

This ratio will provide an estimate of the dollar value of the line to shippers, receivers, and the community, as compared with the annualized present-value dollars invested in operating, maintaining, and upgrading the rail line. A ratio greater than 1.0 indicates that the value accruing to shippers, etc., from operating the line exceeds the cost of retaining the line. A ratio less than 1.0 indicates that less than $1 in benefits would be returned for each $1 invested in retaining the line (7:4).

With the objective of categorizing the State's branchlines into six separate rail system priority levels, this procedure has been used by the Iowa Department of Transportation in developing its state rail plan. Although considerable effort is required to estimate the ratio for a given line, this procedure is less costly than possibly making erroneous decisions based on indices having no clear meaning. The ratio also enables rail planners to determine the most economically efficient use of upgrading funds from

railroad companies, rail users, and state and federal governments (7:4).

Public financing of transportation is claimed to discriminate between competing modes and to also lack consistency. In most cases, however, no systematic accounting of costs and benefits is required. Thus, public investments may not always yield the maximum possible benefit. Government aid to rail freight service is largely in the form of loan guarantees, loans, preference shares which may become grants in the event of default, and R & D funding (81:240).

Optimal efficiency in freight transportation in the U.S. requires that the railroads be treated, so far as the role of government in financing is concerned, in a fashion as close as possible to that of the trucking and barge industries, after recognition of inherent differences among these modes. To ensure equal treatment, i.e., since government finances both highways and waterways (a practice almost certain to continue), government participation in financing railraods is also essential (24:16).

Under one proposal, for example, the government would buy and maintain the railway track, charging the railroads for its use on a competitive bid basis. On a nationwide scale, this approach would involve large federal outlays. The determination of maintenance expenditures by area and

line on the basis of political considerations would also result in inevitable conflict. Competition among several lines operating on the same track is impossible, since it is not technically feasible to allow a number of railroads to operate on the same track. Experience has demonstrated that even two lines with voluntarily negotiated agreements have problems, particularly over train priorities. While widespresd federal ownership of the rail lines is open to serious question, state or local government purchase of deteriorated lines has merit, particularly in assuring shippers that the government is serious about maintaining continued line operation (24:17).

A major argument for state participation in railroad financing is based upon factors external to the preservation of rail service (24:18). These include:

1. Reduced congestion on highways, which has been aggravated by the increased size of trucks. This would reduce discomfort for automobile drivers, decrease accidents, and lower maintenance costs.

2. Reduced energy consumption and pollution would result because railroads are more fuel efficient than trucks.

3. Reduced regional economic losses would result as further business development is encouraged.

For the government to allow wholesale liquidation of rail lines that are viable from a long-range perspective, but

that are unable to withstand a serious recession would be intolerable from an economic efficiency standpoint (24:18).

There is increasing evidence that the rail industry could, as a whole, earn a reasonable return if there were drastic revisions of labor union contracts. The revisions need to increase labor productivity and bring wage costs to levels comparable to those in other industries. Much of the blame, however, for noncompetitive labor costs rests with the federal government, which consistently supported labor's position. Also, some states have added to the problem by enacting economically unsound full-crew laws. Therefore, governmental assistance for a breakthrough in the restructuring of labor contracts is imperative. One suggested approach is a governmental provision of reasonable severance pay for workers losing their jobs through operating changes and abandonment (24:19).

The railway industry should not be left entirely to the market mechanism, given governmental participation in highway and waterway financing and operation, external factors, and the nature of rail industry rates of return. Establishing systems of financial aid requires that they be designed in such a way that they do not (1) merely cover deficits and thus encourage inefficiency, and (2) preserve uneconomic provisions in labor agreements and wage levels above those for comparable work (24:20). Unfortunately there are obstacles in the attainment of government

financing of railways. However, the major obstacle appears to be the current Administration's laissez-faire business philosophy and its hopes to reduce the federal budget (24:21).

Shipper Retention

The ICC's recent booklet, Guidelines for Evaluating the Feasibility of Shortline Operations, and the ICC procedures referenced in Ex Parte No. 392, Application Procedures for a Certificate to Construct, Acquire, or Operate Railroad Lines, 365 ICC 516 (1982), suggest that there are up to nine different legal mechanisms to aid entry into the shortline railroad business (37:70-71). These mechanisms include the following:

1. Section 11343-44, 49 USC, (formerly Section 5(2)) of the Interstate Commerce Act allows acquisition of non-abandoned line by another carrier. However, since applicants must assume labor protection, this procedure should generally be avoided.

2. Section 10901, 49 USC, (formerly Section 1(18)) is applicable to requests by a non-carrier or newly formed entity to acquire and operate a line of a railroad. The ICC usually does not impose any labor protection under this statute.

3. Section 10905, 49 USC and 45 USC Section 748(d)

permit any financially responsible entity who buys a proposed abandonment property through applicable financial assistance to initiate common carrier service without separate 10901 application. Further, the ICC may compel the carrier to sell for no more than the line's net liquidation value (NLV) or 75 percent of NLV for certain Conrail lines.

4. Section 1120A, 49 CFR, allows operation over a right-of-way previously acquired by a public agency.

5. Section 10505, 49 USC, permits approval exemption by the ICC when the purchase application is of a limited scope and the operation is not necessary to carry out national transportation policy.

6. Acquisition of trackage from bankrupt carriers requires that the purchaser must obtain approval from both the bankruptcy court and the ICC.

7. Designated operator certificates under the 3-R Act make entry and exit very simple, but are limited to new or existing carriers designated by Section 304.

8. Staggers Act feeder-line acquisition procedures help entities faced with inadequate rail service to compel the operator to sell the branchline.

9. Actions outside the jurisdiction of the Interstate Commerce Act include transfer of lines to or from the

Conrail system or liquidation of the entire system. In those cases, the Secretary of Transportation has primary decision authority.

Funding. Shortline acquisitions are commonly financed in several ways. These are (1) government funding (limited to purchasing and rehabilitating the right-of-way), (2) private venture capital (wealthy investors looking for financing opportunities), (3) car leasing firms desiring opportunities, (4) shipper financing in the form of a loan, stock purchase, or prepaid freight, (5) investments by employees, promoters, and associates, (6) debt financing through a local bank or lending institution, or (7) short term financing by the sellers to obtain new traffic or seek trackage rights (37:71).

Since railroading is still viewed by many in the financial community as an exceedingly risky enterprise, financing is frequently difficult to obtain. A prospective entrepreneur searching for funding must anticipate obtaining capital to cover not only the cost of the track, right-of-way, and other fixed facilities, but also engines and rolling stock, rehabilitation and improvements, and maintenance equipment. More importantly, entrepreneurs must obtain sufficient startup money to provide some working capital (37:71).

Federal funding seems likely to be much less generous

than before. Recent legislation for local rail service assistance authorized $40 million for fiscal 1982, $44 million for fiscal 1983, and $48 million for fiscal 1984. These funds, however, are intended more for capital projects, mainly track upgrading, than for operating subsidies. However, there is a big difference between "authorized" and "appropriated" funds, i.e., attempts by the current administration to cut the federal budget may prevent full appropriation (64:56).

Personnel. Once funding has been secured, a cadre of dedicated employees must be hired. Flexible labor agreements permit customized local service that a trunk-line carrier cannot provide. As such, the movement of cars or switching at odd hours is possible under these conditions, to the advantage of both the shipper and the shortline. The shipper is, therefore, able to receive a service he could not otherwise receive, and the shortline is able to move traffic on and off its line with minimal delay and car charges (17:76).

If the management is locally based, a positive parochialism leads to partnership with local industry. "On-site" management not only understands local business conditions but can respond quickly to shippers' requests and complaints (64:56). For example, one of the elements of the Hillsdale County Railway's success is its local representation among its employees and among shareholders

(34:39). The shortline itself can also become a local industry, using local banks and suppliers, thereby contributing to the same economy that it helps support by providing transportation.

Disadvantages and solutions. The tiny Cape Fear Railroad, serving Fort Bragg and Pope Air Force Base, North Carolina, lost much of its traffic to motor carriers because of its diminutive capacity. It survives now only because it is allowed to supplement its income by repairing freight cars at the depot. A licensing agreement, which replaced the former maintenance and switching contracts, permits the railroad to generate revenue by repairing railcars as well as hauling freight. It is also required to maintain its two Army locomotives and 25 miles of track (18).

The inability of a shortline to attain operational efficiency due to its small size can, in part, be alleviated by the concept of regional subsystems. Generally, this concept involves uniting two or more shortlines to form a larger system capable of more economical, efficient operation. The bond need not be a merging of the units, but could instead be simply an agreement to share certain equipment (repair, maintenance, locomotives), facilities (shops and repair areas), and services (accounting and data processing) (17:77). As happened with the broadcasting and cable industries,

shortline railroaders have discovered the many advantages of owning several disconnected properties (37:68). There are approximately six such groups which are generally recognized as good operators. Among them are (1) the Delaware Otsego Corporation, a holding company for five small railroads in New York, Pennsylvania, and New Jersey, (2) the Hillsdale Group, operating 62 miles of abandoned Penn-Central trackage in Michigan, (3) Rail Management Services, the holding company for the Ontario Midland and the Ontario Central in New York State, the Virginia and Maryland, and the Maryland and Delaware Railroads, and (4) Genesee and Wyoming Industries, also of New York (64:60).

Another issue that cannot be overlooked is the nature of the relationship established between the shortline and its Class I connections. Some Class I railroads such as Conrail regard shortlines as friendly partners in retaining attractive traffic without the operating expenses and managerial headaches of branchline railroading. Conversely, other Class I railroads still view shortlines as parasites and would rather see the lines abandoned (37:70).

This negative relationship is due primarily to the seemingly unfair division of payments that shortlines receive from other railroads. It is not uncommon for a shortline to receive a division of 20 percent of the freight charges. Thus, if a commodity moved 990 miles by one carrier and 10 miles by the shortline, the shortline

would receive 20 percent of the total revenue for one percent of the distance hauled (17:77).

Summary. Some shortlines clearly have slim chances for profitability, particularly if they fall into the hands of politicians or inexperienced enthusiasts, or if the main goal of their backing is to support tax shelters such as equipment leasing. Also, management unfamiliar with or unprepared to deal with all aspects of this complicated business will inevitably experience problems (64:56).

Increased Traffic

In past studies, eighteen rail lines in the state of Indiana were analyzed, revealing the following savings, based on service variations (17:82-84):

1. Decreasing frequency of service by one day a week saved 7.8 percent of the on-branch costs and produced a 17.4 percent decrease in aggregate net loss;

2. Decreasing the time required to serve the branch by 25 percent decreased total segment costs by nearly 9 percent, while the net loss was reduced almost 20 percent ;

3. Reducing crew size by at least one crew member, cut on-branch costs by 4.2 percent, while the net loss was

reduced nearly 10 percent .

Obviously, in several cases all three of the above alternatives could be used simultaneously. If this were done, the on-branch costs would decrease by almost 17 percent, and the net loss would drop by 37.5 percent. Expressed in dollars, the net loss would drop from $2.5 million to $1.5 million. USRA subsequently concluded that lines within 10 percent of a break-even figure could be retained. This is accurate since cost savings in excess of this percentage are quite possible with only minor adjustments to the service level. Clearly, changes of these magnitudes merit the consideration of altered service levels as an alternative to rail line abandonment (17:84).

Military rail units. A shortage of military railway personnel began in the early 1970s when agencies anxious to pare inflation-swollen budgets, pruned "anachronistic" units from the force structure. Due to these on-going budget and manpower reductions, most DOD installations are staffed with less than five personnel to operate and maintain the assigned rolling stock. In addition, the only training these personnel receive is a six-week rail program at the Tooele Army Depot rail shops located at Hill Air Force Base, Utah (133:9).

The last active duty railway unit was deactivated 15 June 1972 with the remaining Transportation Railway Service

(TRS) capability allocated to the reserves. Further pruning will destroy the TRS as an effective military force. Once the TRS has been allowed to end, only an extraordinary effort could restore it to usefulness. In an emergency, that effort may not be in time (104:8).

There are a number of very compelling considerations supporting the retention of TRS units, including the following:

1. The civilian railroads of the U.S. no longer have the capability of providing significant numbers of managerial, operating, and maintenance personnel to the TRS in time of mobilization or conflict as they have done in the past (104:20).

2. Among all transportation modes, inclement weather affects rail the least. In addition, no one seems to dispute the fact that throughout the world, rail transportation will be with us for some time (104:10).

3. Rail provides an economy of personnel unsurpassed by any other theater-oriented mode. For example, a three-man crew can easily move a twenty-car train with an average load of twenty tons of cargo per car (104:10).

4. Should nuclear weapons be employed, railroads may be expected not only to survive, but to recover as well as, or better than, other transportation modes. The relatively

minor effect of atomic bombing is indicated by the fact that regular rail service was resumed through Hiroshima within 18 hours after that city's atomic bomb was dropped (104:12; 12; 53).

5. Reliance on overseas "host country" support violates our spirit of independent national military preparedness against potential threats (104:19). This reliance could be a risky gamble because of increasing numbers of Communists in Western European railroad trade unions (104:16).

Thus, increasing, rather than undermining, the number of effective organic railroad units and the amount of training they receive could easily increase traffic on connector lines. Finding a home for the MX missile could also be a solution to the traffic increase alternative.

MX Missile basing. The idea of a railroad basing mode for strategic missiles was first considered in 1960 when the Minuteman was being developed. Today, the old plans and test results are being dusted off as officials take a tentative look at the feasibility of using the nation's rail network as a hiding place for the MX missile (75:10). Studies by the Air Force and the Congressional Office of Technology Assessment concluded that there "are more miles of track in the U.S. than could conceivably be barraged by any forseeable Soviet arsenal"; also, "the

Soviets could not wipe out an MX system based on the U.S. railroads [77:16]."

Although operational requirements would dictate that the MX railroad be a discrete system not used by commercial railways, the railroad connections from the proposed base locations to the commercial line are necessary to allow the transfer of missile components, supplies, and personnel (120:5-7).

Financial Assistance

Contracts enabling individual shippers to negotiate for service specific to their needs, and to reject the supply of unwanted services, are suggested forms of financial assistance. Contracts can incorporate such features as incentives, penalties, car supply guarantees, and service standards that will reduce the shipper's own costs. These advantages of rail contracts to the shipper can be expanded as follows (28:43):

1. Guaranteed car supply and established schedules make investments by lending institutions less risky;

2. Pricing confidentiality fosters innovative and competitive pricing because no pricing information is revealed to the public when the contracts are filed;

3. Unique ratemaking allows carriers to take into con-

sideration real costs and competitive factors, whereas collective ratemaking forced carriers to use rates not tailored to their specific operations;

4. Shortened transit times can be negotiated at the same or higher rate and still produce savings through lower inventory costs.

The benefits of contracting must also recognize the diversity of forms that contracting may take. That diversity stems from differences in the market conditions in which the negotiation and performance of contracts are carried out. For example:

1. Contracts negotiated and performed under competitive conditions benefit both parties by ensuring that rates will approach a competitive level sufficient to cover the incremental costs of the movement. In order to economize on enforcement costs, such contracts will generally be short-term (4:38).

2. Contracts negotiated under noncompetitive conditions, while expected to produce rates that are higher than the competitive level, can still improve the quality of service. Many so-called "captive" shippers will rationally choose contracting over common carriage because common carriage forces shippers to pay for bundles of services whether or not they want them (4:39).

3. Contracts carried out in a noncompetitive environment are effectively competitive in the negotiating stage, generally long-term, and require one or both parties to undertake costly investments. The contract guarantees the relationship, thus preventing major loss in the substantial capital investments (4:40).

Long-term contracting has also encountered problems with antitrust regulation on the presumption that it tends to hinder competition. Concern that the antitrust authorities might misinterpret the purpose of certain contracts has imposed added costs on firms who agree to contractual terms that were less than optimal but that pose less of an antitrust risk (4:41). Consequently, shippers should be cautious to avoid "per se" violations that courts might automatically consider illegal. For example (29:57):

1. A shipper with market power should not induce a rail carrier with market power to refuse to deal with other shippers;

2. A shipper with substantial market power over a product or service should not condition a sale or purchase upon an agreement of sale or purchase of another product or service, over which the seller or buyer does not have market power;

3. A shipper should not agree to purchase transportation from only one railroad;

4. A shipper should not assist a combination of railroads in a plan to establish uniform contract rates, discounts, credit terms, etc.;

5. A shipper should not enter agreements that artificially allocate traffic among carriers;

6. A carrier should not offer rates which are below service costs and intended to drive competitors out of business.

As a result of the freer market and contracts, the National Industrial Traffic League (NITL) has identified discount-pricing contracts on joint-line moves as the most prevalent abuse by carriers. Some carriers, for example, originating noncompetitive traffic initiate rates at the highest possible level for joint-line traffic, e.g., the intermediate carriers, competing for traffic, offer refunds to shippers in exchange for a contractural routing agreement defining a percentage of the traffic they are to receive. Many shippers then throw these intermediate movements open for bid to all possible bridge carriers to get the maximum rebate. Disguised in the new clothing of railraod contracts, this practice is really the old game of rate wars to gain market share (28:43-44).

Summary

In this appendix we have expanded on the following alternatives to abandonment discussed in Chapter II: (1) state retention (management fees, indexing, cost-benefit studies, equality in mode financing, and funding obstacles); (2) shipper retention (shortline formation -- advantages and disadvantages); (3) increased traffic (service level changes, expanding military rail units, and MX Missile basing); and (4) financial assistance (contractural situations).

APPENDIX F

OUTSIZED EQUIPMENT AND DOD RAIL TRAFFIC

TABLE 25
Outsized Equipment (69:79-86)

LIN	NOMENCLATURE	DIMENSIONS IN INCHES L	W	H	WEIGHT LBS	ITEM PER RAIL CAR
A64869	Angledozer	168.0	132.0	48.0	5000	3 - 57'
A81439	Antenna Tlr Mtd	256.0	103.0	142.5	12890	2 - 57'
A81576	Antenna Tlr Mtd	256.3	103.3	143.0	12765	2 - 57'
A81713	Antenna Tlr Mtd	256.3	103.3	143.0	12830	2 - 57'
C22469	Bridge Ferry End Bay	507.5	144.0	124.0	51600	1 - 57'
C22606	Bridge Ferry Interior Bay	507.5	144.0	103.0	46700	1 - 57'
C25620	Bridge Float Mbl Aslt	506.0	144.0	114.0	33875	1 - 57'
(Component)	Interior Bay	300.0	144.0	28.0	14295	2 - 57'
C35415	Bldzer Earth Moving	102.5	136.5	44.3	3920	6 - 57'
C35826	Bldzer Earth Moving	105.8	136.5	45.3	5380	6 - 57'
E56577	Cbt Eng Veh FTRAC	287.8	145.0	127.5	108030	1 - 80 TON
(Component)	Moldboard Assy	146.3	37.5	14.3	2480	c/
E56578	Cbt Eng Veh FTRAC	287.8	145.0	127.5	108080	1 - 80 TON
(Component)	Moldboard Assy	146.3	37.5	14.3	2480	c/
F39378	Crane Whl 20T W/Boom	344.0	126.5	149.0	57380	1 - 57'
(Component)	Boom Point Section	197.0	32.3	30.3	1480	c/
(Component)	Boom Foot Section	183.5	45.1	30.3	2000	c/
F39926	Crane-Shovel Cwl Mtd	215.0	136.1	142.6	76620	2 - 80 TON
(Component)	Counterweight	128.0	28.5	18.5	4380	c/
F40063	Crane-Shovel Cwl Mtd	238.5	154.0	144.5	96320	1 - 80 TON
(Component)	Counterweight	116.5	25.3	20.5	4380	c/
F40200	Crane-Shovel Cwl Mtd	239.0	136.5	141.0	97100	1 - 80 TON

a/ Item exceeds 128" (width) or 137" (height) (44" above rail) or 26 STON.
b/ Preferred model, reduced dimensions TB 55-46-1.

c/ These items are not rail outsize and will be consolidated with other unit equipment shipped by rail

TABLE 25 (continued)

LIN	NOMENCLATURE	DIMENSIONS IN INCHES L	W	H	WEIGHT LBS	ITEM PER RAIL CAR
(Component)	Counterweight	126.0	25.8	15.5	3600	c/
F40337	Crane-Shovel Cwl Mtd	236.0	136.0	153.0	92000	1 - 80 TON
F40474	Crane Cwl Mtd 40T W/Boom	222.0	135.5	152.0	84330	1 - 80 TON
(Component)	Boom Foot Section	300.0	65.0	44.5	2980	c/
(Component)	Boom Point Section	317.6	47.3	44.5	3940	c/
F40611	Crane-Shovel Cwl Mtd	252.0	148.0	148.0	132000	1 - 80 TON
F43414	Crane Trk 20T W/Boom	340.8	122.5	149.5	52965	1 - 57'
(Component)	Boom Foot Section	183.0	39.0	30.3	1045	c/
(Component)	Boom Point Section	194.0	32.3	30.3	1220	c/
F50221	Crush Screen & Wash	480.0	124.0	144.0	65000	1 - 57'
F50721	Crush Jaw Whl Mtd	410.0	108.0	144.0	72030	1 - 57'
F50858	Crush Jaw Whl Mtd	441.0	119.0	160.0	72120	1 - 57'
F51132	Crush Roll Whl Mtd	495.0	118.0	143.0	61450	1 - 57'
F51632	Crushing & Screening Unit	352.0	126.0	156.5	50990	1 - 57'
G29976	Ditch Mach Cwl Mtd	294.0	132.0	135.0	30000	2 - 57'
G52994	Drier Aggr Tlr Mtd	468.0	127.3	145.0	38300	1 - 57'
G53131	Drier Aggr Tlr Mtd	413.8	125.3	147.5	36200	1 - 57'
H56465	Feeder Aggr Stlr Mtd	390.5	119.0	152.5	15930	1 - 57'
J74215	Grader Control Unit	341.8	122.1	155.3	29380	1 - 57'
J97093	Gun FA Sp 155MM	402.0	161.0	140.0	96000	1 - 80 TON
K56981	Howitzer SP 8-Inch	264.8	124.0	107.8	57630	2 - 57'
L37030	Landing Veh Tracked	477.2	152.5	128.5	82750	1 - 57'
L43330	Lchr Bridge Tk Mtd	323.0	144.0	118.0	95600	2 - 100 TON
L43364	Lchr Bridge Tk Mtd	340.0	144.0	112.0	87700	2 - 100 TON

TABLE 25 (continued)

LIN	NOMENCLATURE	DIMENSIONS IN INCHES L	W	H	WEIGHT LBS	ITEM PER RAIL CAR
L45534	Lchr Rkt 762MM Trk Mtd	513.0	120.0	147.5	42680	1 - 57'
L75803	Loader Bucket	234.0	117.0	222.0	20500	2 - 57'
L75940	Loader Bucket	234.0	117.0	222.0	20500	2 - 57'
L81406	Logging Tractor	158.4	121.8	150.5	11136	3 - 57'
M53877	Mixer Bitum Tlr Mtd	251.8	119.5	140.0	31400	2 - 57'
N74624	Paver Concrete Cwl Mtd	849.5	121.3	139.8	62500	1 - 85'
N75124	Paving Machine Cwl Mtd	199.3	133.6	88.5	23058	3 - 57'
R11462	Ramp Loading Veh	506.0	144.0	114.0	33875	1 - 57'
(Component)	End Bay	360.0	144.0	52.0	20245	1 - 57'
R50681	Recovery Veh FTRAC	321.0	135.0	117.3	107600	1 - 80 TON
S12712	Roller Twd Sheepft	182.1	175.0	55.0	8480	3 - 57'
(Component)	Draw Bar	132.0	90.0	16.8	590	c/
(Component)	Tie Bar	130.0	27.3	78.5	630	c/
(Component)	Drum	79.5	57.8	55.0	2420	c/
S60133	Screen Unit Aggr Whl Mtd	508.0	106.0	164,0	29650	1 - 57'
S61907	Scrubber & Washer	306.0	117.0	162.0	24970	2 - 57'
S71476	Stlr Reefer 7-1 ½ Ton	386.0	96.3	149.0	10380	1 - 57'
S73942	Stlr Van Ca-go 12 Ton	362.5	96.0	146.5	7380	1 - 57'
S74079	Stlr Van Cargo 12 Ton	346.3	98.3	145.3	15850	1 - 57'
S74096	Stlr Van Cargo 20 Ton	432.0	97.0	156.0	27500	1 - 57'
S74764	Stlr Van Office 6 Ton	293.0	97.3	144.0	12000	2 - 57'
S75175	Stlr Van Supply 12 Ton	345.5	97.3	142.0	15110	1 - 57'
U58875	Superstructure End Bay MAB	284.6	145.0	54.5	19500	2 - 57'
U58878	Superstructure Interior Bay MAB	395.7	144.0	27.0	14000	1 - 57'
U58881	Superstructure Transporter	509.5	144.0	114.5	31905	1 - 57'

TABLE 25 (continued)

LIN	NOMENCLATURE	DIMENSIONS IN INCHES L	W	H	WEIGHT LBS	ITEM PER RAIL CAR
V12964	Tank Cbt FTRAC 90MM					
	Model M47	280.3	138.3	120.3	95083	2 - 100 TON
	Model M48	283.0	143.5	114.5	93100	2 - 100 TON
	Model M48C	292.5	143.0	107.5	83400	2 - 100 TON
	Model M48A1	285.6	144.0	118.8	98210	2 - 100 TON
	Model M48A2	285.6	145.0	118.8	97949	2 - 100 TON
	Model M48A2C	286.5	144.0	116.3	95300	2 - 100 TON
	Model M48A3	281.5	143.5	117.0	99500	2 - 100 TON
V13101	Tank Cbt FTRAC 105MM					
	Model M60	320.0	144.0	126.3	95300	2 - 100 TON
	Model M60A1	325.0	144.0	128.3	97000	2 - 100 TON
V13237	Tank Cbt FTRAC 120 MM					
	Model M103	400.5	143.0	128.8	117000	1 - 80 TON
	Model M103A1	400.5	143.0	128.8	117000	1 - 80 TON
	Model M103A2	400.5	143.0	128.8	117000	1 - 80 TON
V13270	Tank Cbt FTRAC 152 MM	275.5	143.5	129.8	109980	1 - 80 TON
W76679	Tractor FTRAC	267.8	130.8	102.0	44780	2 - 57'
W77501	Tractor FTRAC	228.0	136.0	125.0	48088	2 - 57'
W91064	Tractor Whld	290.0	136.0	137.0	52200	2 - 57'
W97592	Trailer Low Bed 60 Ton	445.0	136.0	76.3	21570	1 - 57'
X00696	Trainer Tank 90MM	259.5	170.0	98.5	27429	2 - 57'
X52750	Truck Lift Fork	192.0	92.8	152.9	18430	3 - 57'
YA0022	Crush & Screening Unit	387.0	102.0	159.0	45000	1 - 57'
Y30013	Wash & Screen Unit Whl Mtd	439.3	119.3	171.5	38430	1 - 57'
(Component)	Screen Vibrator	170.8	94.3	76.0	8880	c/
(Component)	Washer	146.3	80.5	81.3	8700	c/
(Component)	Piping Equipment	378.3	54.8	5.8	11710	c/

TABLE 26
DOD Rail Traffic (69:43-48)

State/City	Rail Carloads
ALABAMA	
Alamet	266
Anniston	251
Birmingham	55
Bynum	2,516
Goodway	212
Maxwell AFB	114
Mobile	931
Sylacauga	191
Tuscaloosa	264
ARIZONA	
Ballemont	362
Wilmot	166
ARKANSAS	
Baldwin	475
Calico Rock	55
Conway	79
Pine Bluff	295
CALIFORNIA	
Alameda	180
Bagdad	55
City of Industry	150
Clyde	400
El Monte	226
Herlong	733
Kaiser	53
Lathrop	499
Long Beach	249
Los Angeles	179
Lyoth	952
Manix	66

State/City	Rail Carloads
CALIFORNIA (cont.)	
McKay	54
Merced	55
National City	151
Oakland	562
Planehaven	57
Polk	489
Port Chicago	3,250
Port Hueneme	151
Ranch House	162
Richmond	50
Riverbend	203
Sacramento	69
Santa Clara	201
San Diego	229
San Francisco	125
San Jose	157
San Pedro	60
Stockton	235
Tangair	51
Vallejo	97
Vernon	646
Westminster	58
W. Yermo	400
COLORADO	
Avondale	1,321
Kelker	254
Oak Creek	187
CONNECTICUT	
Groton	69
FLORIDA	
Jacksonville	551

TABLE 26 (continued)

State/City	Rail Carloads
FLORIDA (cont.)	
Lynn Haven	1,023
Miami	142
Milton	445
Mossy Head	77
Naranja	57
Orlando	66
Pensacola	465
Tampa	75
Yukon	78
GEORGIA	
Albany	179
Atlanta Army Depot	312
Fort Benning (Benning Junction)	90
Doraville	50
Dosaga	313
Homerville	133
Lockair	140
Moody Field	1,021
Warner Robins (Robins AFB)	346
Sandhill	82
Valdosta	200
Vogel	51
Walthourville	236
IDAHO	
Boise	169
Mountain Home AFB	155
Pocatello	65
ILLINOIS	
Chicago	177
Decatur	66
Joliet	2,228
Joliet Arsenal Area	119
Proving Ground	419
Rock Island	621
Savanna	81
Wood River	181
INDIANA	
Austin	93
Bunker Hill	101
Charlestown	1,323
Crane	1,852
Dana	154
Evansville	56
Ft. Wayne (Wayne)	52
Grissom AFB	80
South Bend	497
Terre Haute	132
Whiting	195
IOWA	
Council Bluffs	274
Sergeant Bluff	265
Waterloo	299
West Burlington	2,550
KANSAS	
Kansas City	241
Parsons	3,292
Riley	126
KENTUCKY	
Avon	302
Caney Creek	495
Edgoten	219
Estill	139
Fort Estill	1,283
Fort Knox	335
Leatherwood	137
Louisville	80
Peyler	200
Tilford	80
LOUISIANA	
Alexandria	109
Barksdale AFB	368
Bossier City	79
Doyline	1,337

TABLE 26 (continued)

State/City	Rail Carloads
LOUISIANA (cont.)	
Fort Polk	197
New Orleans	1,397
Rapides	539
Shreveport	884
MAINE	
Limestone	100
MARYLAND	
Aberdeen	124
Baltimore	242
Indian Head Jct	130
Landover	76
MASSACHUSETTS	
New Bedford	53
Otis AFB	96
MICHIGAN	
Bay City	2,182
Center Line	361
Grand Rapids	160
Hart	58
Lansing	605
Manistee	62
Milan	65
Skeel Spur	2,206
Warren	137
MINNESOTA	
Fridley	52
Moorhead	736
New Brighton	417
Ripley	66
St. Louis	132
MISSISSIPPI	
Gulfport	302
Jackson	132
Shelby	190
MISSOURI	
Independence	65
Lake City	767
Newburg	367
St. Louis	242
West Plains	98
MONTANA	
Malmstrom AFB	63
NEBRASKA	
Omaha	62
NEVADA	
Hawthorne Ammo Depot	120
Henderson	83
Thorne	1,115
NEW JERSEY	
Bayonne	804
Earle Ammo Depot	214
NEW MEXICO	
Alamagordo	80
McCune	594
NEW YORK	
Brooklyn	169

TABLE 26 (continued)

State/City	Rail Carloads
NEW YORK (cont.)	
Calcium	112
Kendaia	484
Little Falls	70
West Point	80
NORTH CAROLINA	
Beaufort	10,203
Bryson City	71
Camp LeJeune	419
Cherry Point	2,509
Durham	90
Edenton	59
Fayetteville	972
Fort Bragg	2,571
Goldsboro	312
Jacksonville	556
Leland	3,739
Millers	5,679
Winston-Salem	55
NORTH DAKOTA	
Grand Forks (AFB)	858
Mandan	1,766
Minot (AFB)	302
Tatman	2,158
Williston	296
OHIO	
Akron	162
Atlas	256
Cincinnati	579
Columbus	653
Dayton	54
Fairborn	145
Lima	73
Lockbourne	449
Mansfield	132
OHIO (cont'd)	
Patterson	824
Rickenbacker AFB	62
St. Mary's	299
OKLAHOMA	
Altus	502
Ft. Sill	338
Haywood	719
McAlester Ammo Depot	63
Midwest City	61
Savanna	904
Stringtown	55
Tinker AFB	59
OREGON	
Klamath Falls	78
Ordnance	269
Portland	115
Riddle	73
PENNSYLVANIA	
Berwick	72
Bethlehem	54
Chambersburg	85
Cornwells Heights	108
Culbertson	861
Indiantown Gap (Military Reservation)	105
Johnstown	56
Lemoyne	136
Letterkenny Army Depot	602
McKees Rocks	143
Mechanicsburg	1,796
New Cumberland Army Depot	1,087
Parkesburg	105
Philadelphia	171

TABLE 26 (continued)

State/City	Rail Carloads
PENNSYLVANIA (cont.)	
Scranton	636
Tobyhanna (Army Depot)	271
York	639
RHODE ISLAND	
Davisville	130
SOUTH CAROLINA	
Cane Savannah	271
Charbulk	1,704
Charleston	884
Inness	239
Jackson	168
Miller	110
Mullins	206
North Charleston	100
Sumter	1,489
SOUTH DAKOTA	
Sioux Falls	215
TENNESSEE	
Bruceton	56
Greenville	75
Holston	648
Kingsport	666
Memphis	2,853
Milan	2,458
Tyner	599
TEXAS	
Atlanta	267
Baytown	243
Beaumont	291
Benbrook	1,864
Cadet	67
Carswell AFB	62
Defense	3,304
Fort Bliss	177
Fort Hood	116
Fort Worth	4,696
Garland	262
Houston	120
Karnack	155
Kelly AFB	68
Killeen	445
Mountain Creek	736
Olcott	325
Pasadena	911
San Antonio	213
Sheppard AFB	220
Texarkana	89
Texas City	53
UTAH	
Arsenal	57
Bacchus	162
Hiawatha	216
Hill AFB	601
Ogden	581
Thiokol	104
Tooele (Army Depot)	83
Warner	2,038
VIRGINIA	
Bellbluff	884
Blacksburg	127
Camp A. P. Hill (Milford)	82
Danville	78
Dublin	285
Lee Hall	142
Lynchburg	62
Newington	56
Newport News	95
Norfolk	941

TABLE 26 (continued)

State/City	Rail Carloads	State/City	Rail Carloads
VIRGINIA (cont.)			
Pepper	387		
Portsmouth	186		
Quantico	52		
Wysor	66		
WASHINGTON			
Bangor	65		
Bremerton	216		
Fairchild	1,071		
Fort Lewis	173		
Mobase	112		
Mukilteo	1,364		
Pomona	137		
Seattle	411		
Tacoma	136		
Vancouver	102		
WEST VIRGINIA			
Stone Coal	128		
Stonecoal Yard	62		
WISCONSIN			
Camp McCoy	184		
Douglas	60		
Eau Claire	2,145		
Janesville	75		
Marinette	160		
Merrimac	222		
North Madison	199		
Sparta	51		
Waukesha	53		
WYOMING			
Cheyenne	225		

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